APRIL 9, 1951

Electrical World

Price 35 Cents

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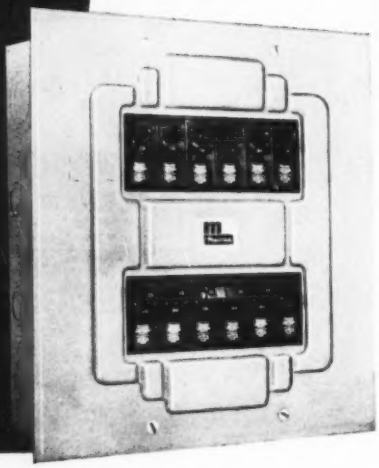
NOW!

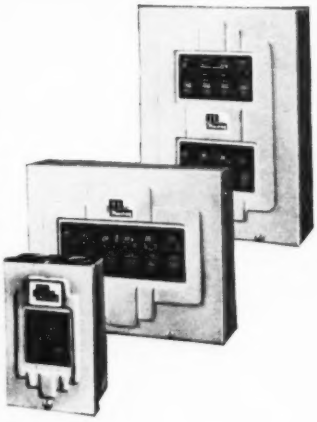
the Murray "12" Circuit Protector

with *Fully Magnetic* breakers

Murray Breakers always carry full load regardless of temperature. Heat will not affect them—they never need "derating." Breakers are interchangeable with other new single pole individually housed breakers. This means utmost flexibility for you with a minimum stock.



Standard package—LG006G—Surface or Flush. Four 15 Amp. plus two 20 Amp. breakers with provision for six additional breakers. Six pairs of handle extensions supplied.



NOW!

a trim, compact 12 Circuit Load Center has been added to the Murray Line. All Murray Circuit Protectors are suitable for use as service equipment.

No main switch is required ahead of the "12" and "8" Circuit Protectors, providing the number of operating handles is limited to six by the use of handle extensions. (National Electrical Code, Par. 2351)

FREE!

Write today for the brand new Murray Catalog describing this and other dependable Murray products.

IF YOU WANT TO INSTALL THE BEST ...specify Murray®

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MURRAY MANUFACTURING CORPORATION

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Service Entrance & Meter Equipment · Magnetic Circuit Breakers · Switches
Current Limiting Reactors · Crows'nest Aerial Ladders

NOTES ON THE NEXT ISSUE

A genuine milestone in transmission history is being made at Bonneville, and the forthcoming issue of "Electrical World" has a great story on it. For the first time in the U. S. 230-kv series capacitors are being used to increase the power limits of a transmission line. The highest voltage capacitors used in this country heretofore were 66 kv. And to save later argument, we'd like to note that 230-kv capacitors **have** been used in Sweden, but they were not applied in the same manner as these.

J. E. Barkle and A. A. Johnson, both central station engineers with Westinghouse, have written a clear and interesting article on the fundamental principles of series capacitor application. And a companion article by R. E. Marbury, Westinghouse capacitor expert, presents the details of the Bonneville capacitor installation.

LIGHTING JOB IN TEXAS

They're always saying that Texans do a lot of talking. We've observed though, that they usually have plenty to back it up with. For example, at the W. B. Ray School in Corpus Christi, they've accomplished one of the finest jobs of school lighting we know of. The installation coordinates daylight and artificial light to get the most out of both and create uniform, shadowless light from windows to wall.

ARC FLICKER

One trouble with the big arc furnaces—used mostly in steel mills—is that they cause a distinct and troublesome flicker on the system. At Duquesne Light Co in Pittsburgh, they've devised a way to connect an arc furnace and keep the flicker to a minimum. B. M. Jones of that company explains it in a way that will interest every power engineer.

SUBWAY TRANSFORMERS

Industry men tell us there's no place on earth that holds more different shades of opinion than a meeting of a committee on standards in the electric industry. Here's **one** where all the pros and cons have been amiably resolved. EEI's standards for subway transformers are now established and are listed and explained in the next issue—along with all of the varied and useful articles noted above.

THE EDITORS

Electrical World

Published for 77 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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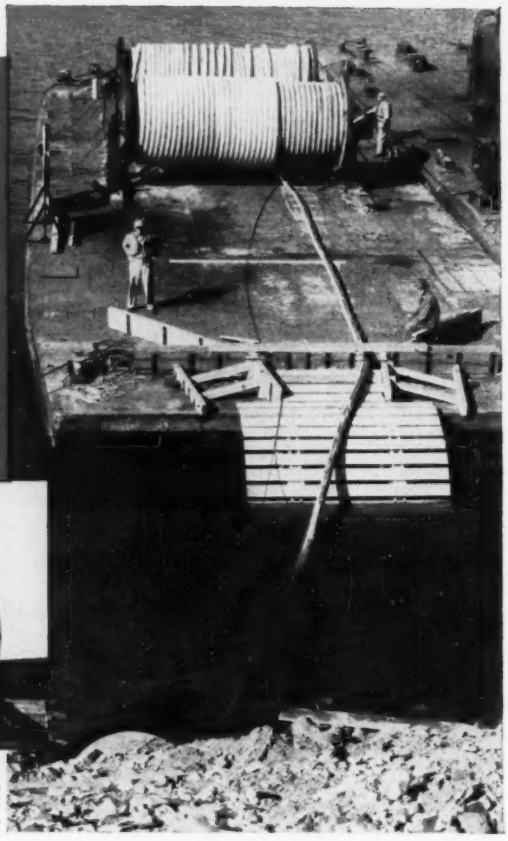
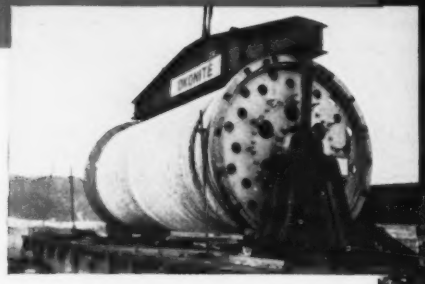
GIANT OKONITE SUBMARINE CABLES BRING MORE POWER TO PORTLAND





Over 55 tons of 5-inch Okonite cable . . . laid across the Willamette River by Portland General Electric Company in just 40 minutes! Okonite reels were specially designed to expedite the job.

Two 13 Kv Okonite submarine cables were recently laid simultaneously across the Willamette River, Portland, Oregon in 40 minutes. This notable engineering feat represents a vital transmission link between a power plant on the east side of the city with the underground system in the west side business district.

Measuring 5 inches in diameter and weighing 31 pounds per foot, these 1800-foot rubber insulated cables were protected by steel armor wire. Special Okonite-designed reels helped to speed the laying.

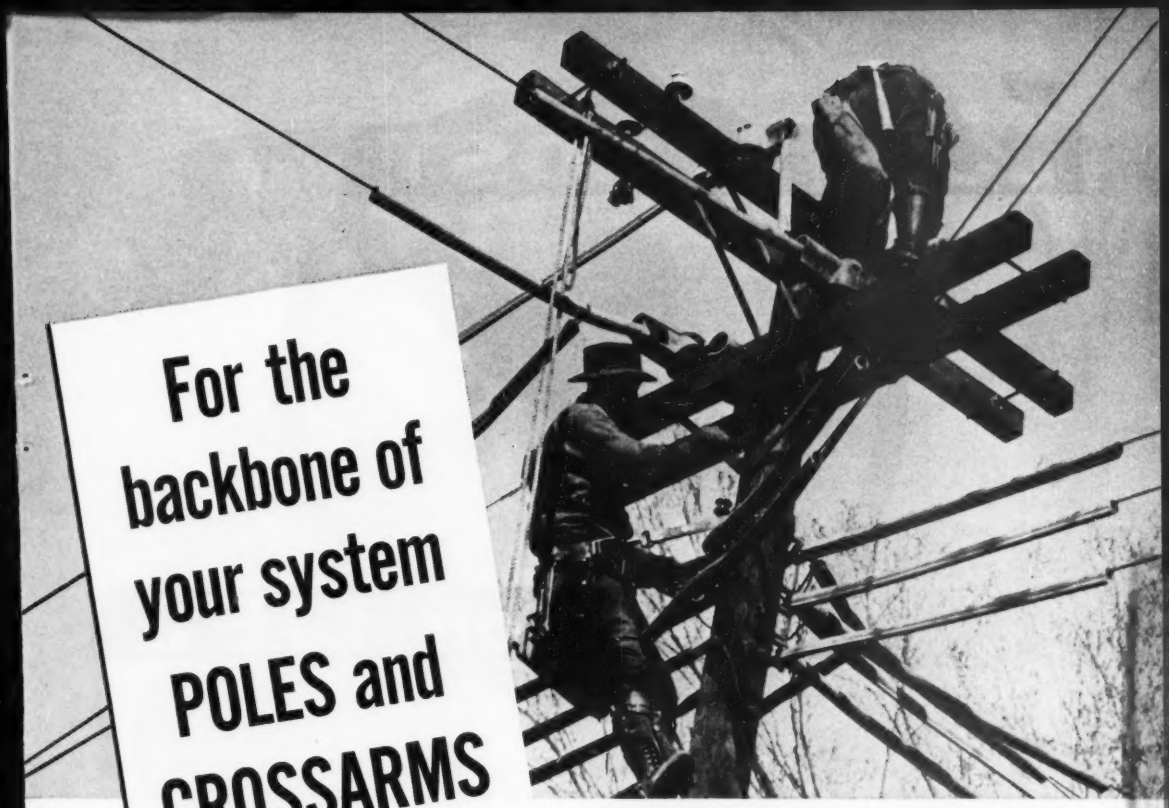
Of particular interest in the engineering of these cables was the high voltage testing used to check out any tiny hidden defects which would not show up under ordinarily-specified test voltages. Designed for operation at 13,000 volts, these cables were tested at 93,000 volts for 15 minutes at d-c during fabrication. After armoring they were tested at 75,000 volts for the same period at d-c — in addition to a-c high voltage tests.

The 500,000 CM conductors in these cables were insulated by the famous Okonite strip process, assuring absolute uniformity of wall thickness . . . perfectly centered conductors. As in other Okonite cables, the insulated conductors were vulcanized in a continuous metal mold under high pressure, resulting in higher density, greater physical and electrical uniformity.

No matter what Okonite cable you buy, you can be sure of obtaining true cable economy . . . the economy of long life and uninterrupted service. The Okonite Company, Passaic, N. J.

THE BEST CABLE IS YOUR BEST POLICY

OKONITE OKONITE SINCE 1878 *insulated wires and cables*



For the backbone of your system POLES and CROSSARMS

Via GraybaR

The pole-line backbone that supports today's essential power lines needs seasoned strength and durability to do its job efficiently and at low maintenance cost.

That's one reason why power companies all over the nation choose Graybar for all their pole-line needs. They know that Graybar-distributed materials are always right for the job and stand up under abnormal stress of storms, ice, and snow.

POLES – Differing conditions lead to different local preferences. That's why Graybar distributes *all* types of poles – full-length, pressure-treated Southern Pine . . . full-length, pressure-treated Fir and Cedar . . . butt-treated Northern and Western Cedar.

All treated poles are carefully selected and processed to provide maximum strength and durability – plus the clean, smooth exterior surface required for city use.

CROSSARMS – Douglas fir crossarms via Graybar are selected and seasoned under rigid methods – are strong, long-lasting, and provide a wide margin of safety in the line.

POLE-LINE SUPPLIES – Graybar also distributes insulators, wire, cable, strand, hardware, tools, and hundreds of other needed pole-line supplies – all products of outstanding manufacturers.

To keep the backbone of your system strong, order your supplies from Graybar. You'll always get dependable items, and the nation-wide Graybar warehouse system helps assure the *fastest possible* deliveries under today's uncertain conditions.

Because Graybar is wholly owned by its operating and retired personnel, you can always expect an extra measure of personal interest in serving you. Feel free to call your local Graybar Representative for information on any electrical item . . . call your nearby Graybar Outside Construction Specialist for planning aid and technical advice. *Graybar Electric Company, Inc. Executive Offices: Graybar Building, New York 17, N. Y.*

148-94

Everything for your pole lines
Via GraybaR

IN OVER 100 PRINCIPAL CITIES

LOW in COST

LONG on LIFE

Low in cost, long on life. That's the simple story of ANHYDROPRENE Wires. And those are the reasons why it pays to remember ANHYDROPRENE whenever you're planning new transmission and distribution systems, or are preparing to rewire those already in use.

ANHYDROPRENE Wires consist only of conductor, the famous Anhydrex insulation, and a thin, but tough, neoprene jacket. On some of the large sizes a tape is inserted between insulation and jacket. This simple construction establishes low purchase cost and produces a small-diameter, lightweight wire that's inexpensive to install.

ANHYDROPRENE construction also provides sound electrical and physical properties. There's the low water absorption and high dielectric strength of Anhydrex insulation. There's the resistance to abrasion, acids, corrosive chemicals, light and flame of the neoprene jacket. At 8000 volts and under, ANHYDROPRENE Wires can be operated at copper temperatures as high as 75°C. These features assure trouble-free service year after year, even under unfavorable conditions. And long, trouble-free service means low installation costs and infrequent replacements.

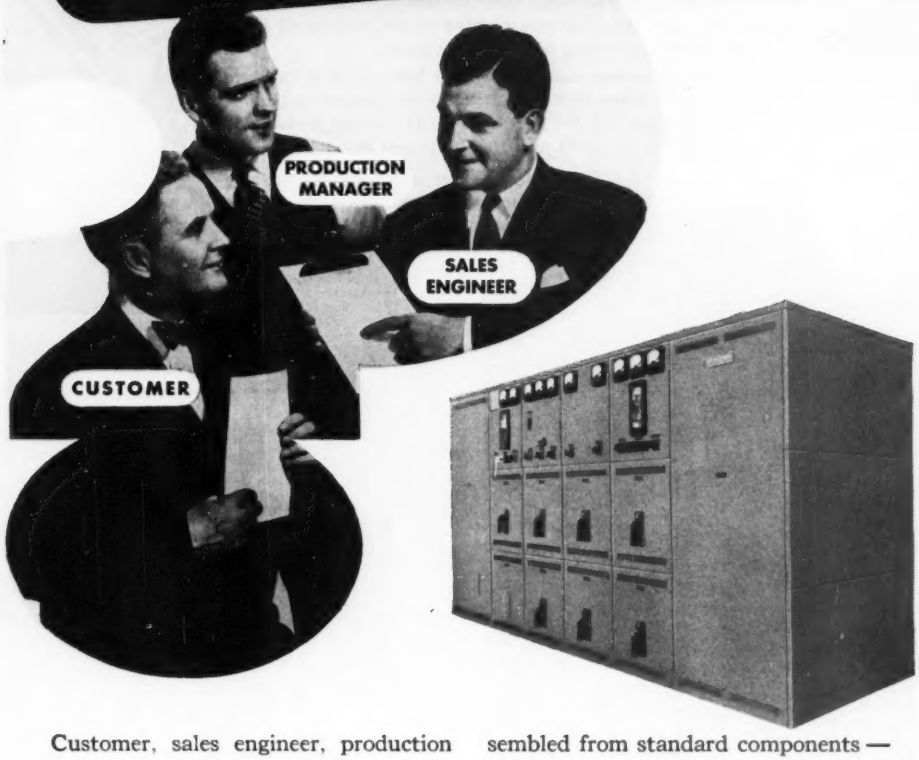
ANHYDROPRENE Wires can be racked on walls and installed underground in ducts. You'll find them especially dependable for plant and shop wiring; for instrument wiring; as underground primaries, transformer leads, and pole line risers; and in signal and control circuits.

Simplex

WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

WHICH MAN IS THE EXPEDITER?



Customer, sales engineer, production manager — all three have a direct influence on the speed with which a switchgear order can be produced and delivered.

But the customer can be most influential by far!

For if he is an experienced buyer, he selects standard arrangements assembled from standard components — and in this way materially speeds engineering, order entry and production. Further, since standard construction evolves from expressed preferences based on the actual experience of thousands of users like himself, he obtains the best possible equipment at the lowest possible cost.

To speed your switchgear delivery

Let your I-T-E representative show you how standard components can be used for your requirements!

For *more dependable* Switchgear

specify I-T-E!

R&IE

I-T-E Circuit Breaker Company • 19th & Hamilton Streets • Philadelphia 30, Pa.

Power Switching Equipment: Railway and Industrial Engineering Co., Greensburg, Pa.

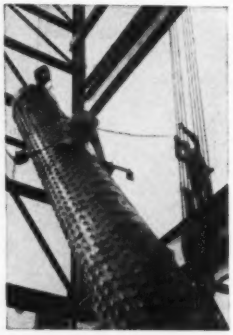
Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

• SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS •

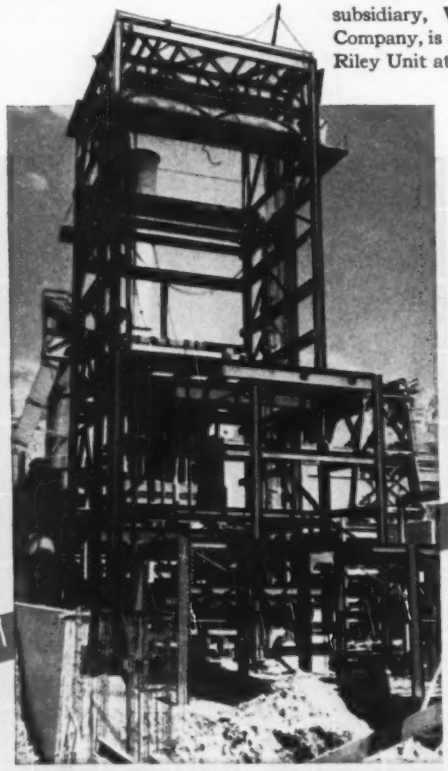
Pattern of Progress at Utah Power

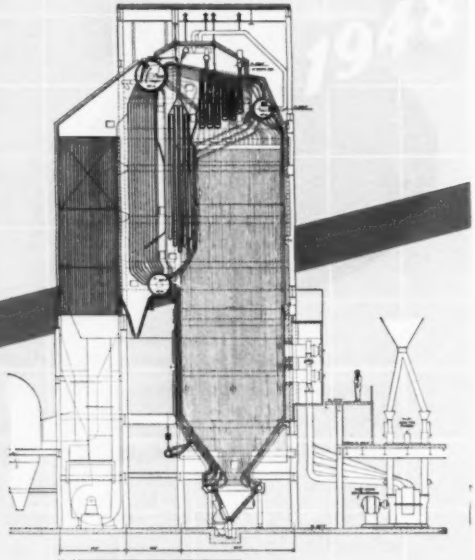
Utah Power and Light Company has instituted a program tremendously increasing its power producing capacity. While their Pattern of Progress includes expansion of many facilities other than their steam power plants, it is an all Riley performance insofar as new steam generating units are concerned.

Utah Power and Light Company installed its first Riley Unit at its Orem Station in 1948—a 450,000 lbs./hr. Riley Unit. Utah Power and Light Company is now installing a 620,000 lbs./hr. 1500 psig 955°F. Riley Unit at its New Jordan Station, and has ordered a 575,000 lbs./hr. 1700 psig 1000°F. reheat Riley Unit to be placed in operation in 1952.



Utah Power and Light Company's subsidiary, Western Colorado Power Company, is installing a 70,000 lbs./hr. Riley Unit at Montrose, Colorado.





450,000 LBS./HR.
1050 LBS.–955°F.

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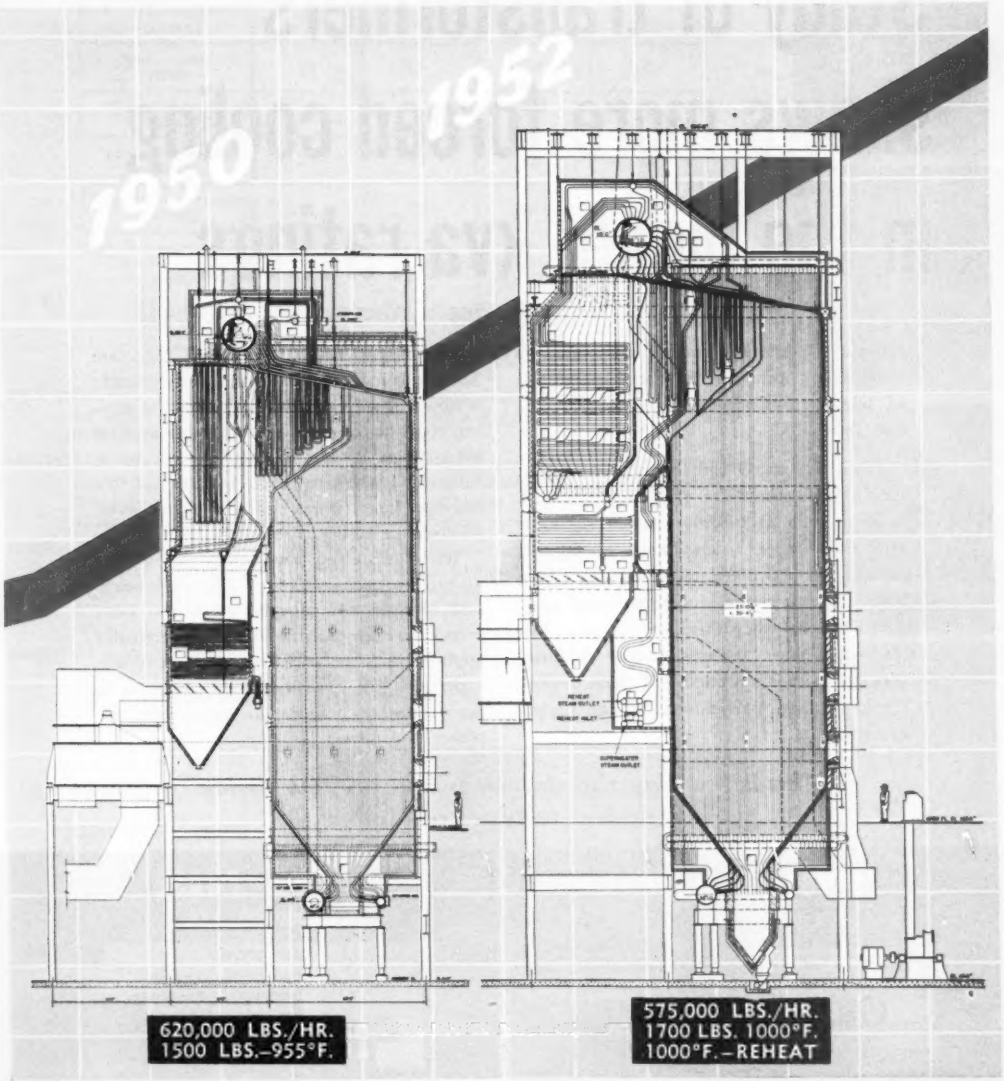
& Light - an all RILEY Performance



A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

Study of transformers shows more forced cooling in the higher kva ratings

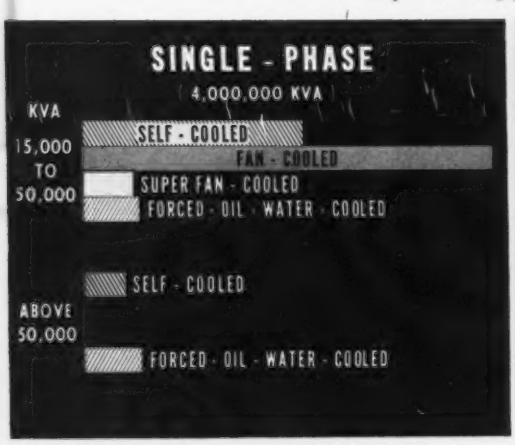
General Electric has recently completed an analysis of approximately fifteen million kva of power transformers, rated 15,000 kva and above.

From this study three trends stand out. First, kva ratings are still climbing, with units as high as 145,000-kva already built and even larger ones being considered. Second, *three* 3-phase units are now being built for every *one* single-phase, as compared to 1940 when there were more orders for single-phase units than for 3-phase. Finally, there is a pronounced trend toward forced cooling, particularly in the higher kva sizes.

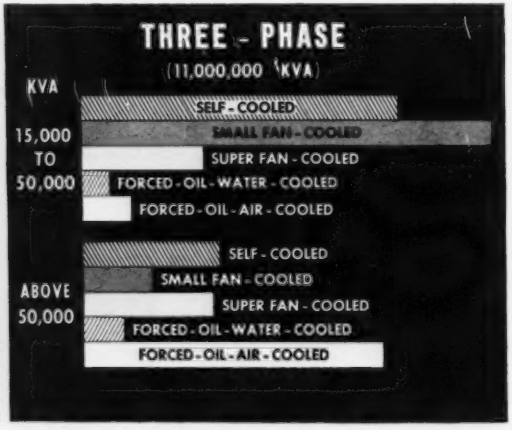
This last trend is particularly important because it indicates that a lot more thought is now being given to the economics of cooling than in the past. Today, with at least six types of cooling to choose from, an intelligent analysis of each installation (see opposite page) is necessary if lowest overall costs are to be achieved.

With unequaled experience in building all types of cooling, General Electric is ready and able to provide you with the most economical transformer for your particular application. You can take advantage of this experience by consulting with your G.E. representative before you buy your next power transformer.

This is the way transformer purchases now divide in respect to types of cooling



NO LONGER IS SELF-COOLING DOMINANT. Below 50,000 kva, half of all new single-phase transformers are fan cooled while another 5% are super-fan cooled. Including units above 50,000 kva, about 13% are forced-oil-water-cooled.


THREE - PHASE
(11,000,000 KVA)
KVA
15,000 TO 50,000
SELF - COOLED
SMALL FAN - COOLED
SUPER FAN - COOLED
FORCED - OIL - WATER - COOLED
FORCED - OIL - AIR - COOLED
ABOVE 50,000
SELF - COOLED
SMALL FAN - COOLED
SUPER FAN - COOLED
FORCED - OIL - WATER - COOLED
FORCED - OIL - AIR - COOLED

IN 3-PHASE TRANSFORMERS, super-fan cooling is definitely on the increase, and now accounts for 23% of the total. Most startling is that 40% of all units above 50,000 kva are now forced-oil-air-cooled.

Type of Cooling*	First Cost (in per cent)	Impedance (OA = 1)	Core Loss (OA = 1)	Copper Loss (OA = 1)
Self-cooled (OA)	100	1.0	1.0	1.0
Fan-cooled (OA/FA)	91	1.25	0.85	1.35
Water-cooled (OW)	85	1.0	1.0	1.0
Super-fan cooled (OA/FA/FA)	80	1.67	0.75	2.1
Forced-oil-air cooled (FOA)	75	1.5	0.8	2.0
Forced-oil-water cooled (FOW)	70	1.5	0.8	2.0

Note: Approximate figures above are based on a 50,000 kva, 138-kv transformer.
* Substation units are usually types OA, OA/FA or OA/FA/FA. Generating station units are usually FOA or FOW.

These are the considerations affecting the choice of transformer cooling

FIRST COSTS—In the table above, different types of cooling are arranged in descending order of first costs. ***Relative*** first costs will generally fall in this same order for units 50,000 kva and higher.

IMPEDANCES—Minimum standard impedances for FOA and FOW transformers are nearly 50% higher than for self-cooled units. However, this is generally a minor problem at step-up stations where losses have minimum cost and where voltage drop can be compensated for by modern generators.

LOSSES—To first cost must be added both the expense of supplying energy losses (copper and iron), and the amount of lost revenue which results from having to supply these energy losses. The total loss can be capitalized and added directly to first cost, or can be computed on an annual basis and added to yearly carrying charges.

INSTALLATION COSTS—These must be added to above costs, but will vary widely with conditions at the site. Generally, minimum installation cost is achieved with FOA transformers. All General Electric transformers are shipped in an ***upright*** position—a factor which greatly facilitates installation.

A Special Look at the Super-Fan-Cooled Transformer

This comparative newcomer, with its three separate ratings, is fast increasing in popularity. Its first cost is between the self-cooled and forced-oil types—so it is the least expensive transformer if you want to avoid oil pumps. It can be purchased without fans where future load growth cannot be predicted—and fans added as necessary. Finally, the industry seems to favor the super-fan-cooled transformer for unattended areas, probably because it has at all times a self-cooled rating.

Through the courtesy of American Institute of Electrical Engineers, we have reprinted an article, "The Choice of Main Power Transformers for Generating Stations," which is pertinent to this whole question. Ask for GET-2225. Write to Apparatus Department, General Electric Company, Schenectady 5, New York.

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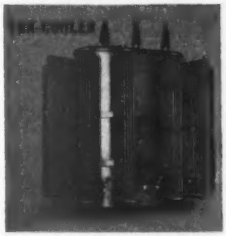
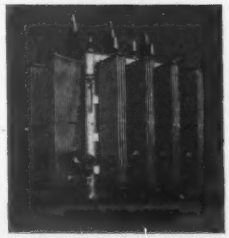
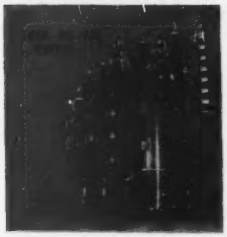




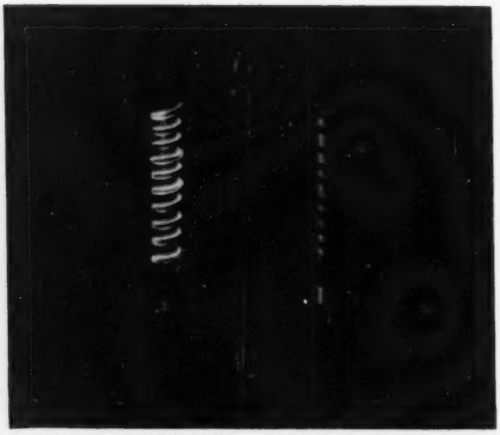


GENERAL ELECTRIC

the spike test proves it!

PS Shielding*

American PS Shielded Cables are perfect for aerial lines. Tree trimming is practically eliminated. Corona troubles vanish . . . along with television and radio interference.



Here's a good example of the way PS Shielding prevents corona formation. The conductor on the left is insulated with unshielded "ozone-proof" rubber. But the PS Shielded Cable on the right is completely free from corona.

PS Shielding is so flexible, light and small that it is easy to manhandle over support rigs in the most rugged country.

PS Shielding provides an extra margin of safety when cable must be dragged over sharp rock and when it must be handled by workers.

USS

UNITED STATES STEEL

by itself is a safety measure

*** an original development of American Steel & Wire Company**

● There's an easy way to prove the effectiveness of PS Shielding. Just drive a spike through the PS conducting rubber tape into the copper conductor *without touching the ground wires.* Your breakers will trip every time, proving that PS Shielding *alone* is an outstanding safety measure for the protection of all who handle your cable.

Naturally, the PS grounded tapes can't carry heavy currents, so they're usually used in combination with ground wires. But PS Shielding will easily handle the circumferential current of the cable. In other words, it will do everything that metallic shielding will do *with these added advantages:*

Prevents Corona Discharge—PS Shielding is so flexible that it never pulls away from the insulation. This is in sharp contrast to metallic shielding which often separates from the insulation when the cable is bent. Each of the resulting gaps is a serious danger point since it may cause spark discharge plus the inevitable corona and ozone formation.

Easy to Splice—PS Shielding is available in rolls. For most splices you can apply your shielding to the splice just like ordinary insulating tape.

Reduces Bulk—PS Shielding has less bulk and weight than metallic shielding. Consequently, the cables are lighter, smaller, and in general—easier to handle.

Increases Cable Life—PS Shielding is so smooth and pliable that it won't chafe the insulation or jacket. There are no fine wires to break when the cable undergoes hard usage.

For the full story on PS Shielded Cables, get in touch with your nearest American Steel & Wire Company office.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

American Electrical Wire & Cable

UNITED STATES STEEL

What does this International have that other trucks don't have?

L-120 International Truck (5,400 pounds GVW) with stake body —one of the 87 basic models, thousands of specialized variations in the world's most complete line of trucks.

1. It has an $11,000,000 valve-in-head engine. The new Silver Diamond valve-in-head power plant is built for truck work—and truck work only—in the world's largest exclusive truck engine plant. You get specialized truck construction that means fewer maintenance bills, longer engine life. You get specialized truck power that means lower operating costs.

2. It has "the roomiest cab on the road." Send your men to work in the most comfortable International ever built. Your men will ride in the Comfo-Vision Cab —"roomiest cab on the road." They'll get full front visibility through a one-piece, curved Sweepsight windshield. They'll enjoy controlled ventilation in any weather.

3. It has Super-steering and Super-maneuverability. A worker isn't all tired out after a drive in a new International Truck. A new International Truck is easy to maneuver in traffic, easy to park, easy to turn in the shortest practical circles. The man behind the wheel enjoys more positive steering control from a more comfortable driving position.

4. It has heavy-duty engineered stamina. You get comfort and easy handling without sacrifice of ruggedness in a light-duty International. Every International—light, medium, and heavy-duty—has heavy-duty engineered stamina in every part. This assures you the savings in operation and maintenance and the long life that have kept Internationals first in heavy-duty truck sales for 19 straight years.

Make your next buy an extra-value International. See your nearest International Truck Dealer or Branch. Get all the facts on how an extra-value International means extra profits for you.

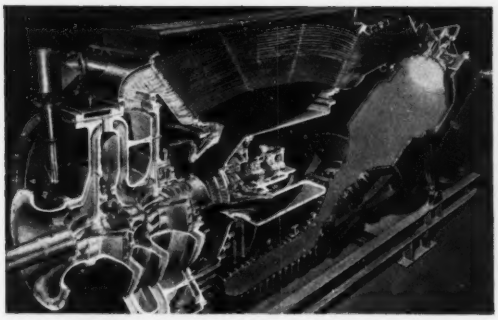
International Harvester Builds McCormick Farm Equipment and Farmall Tractors... Motor Trucks... Industrial Power... Refrigerators and Freezers

International Harvester Company • Chicago

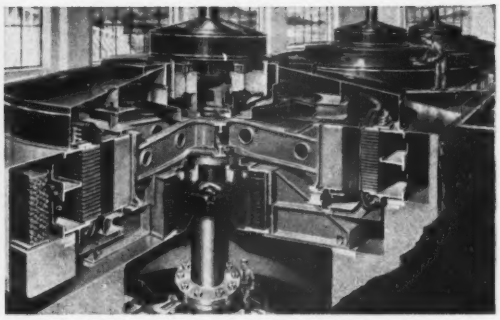
See the new

INTERNATIONAL TRUCKS

Every model heavy-duty engineered for the long haul



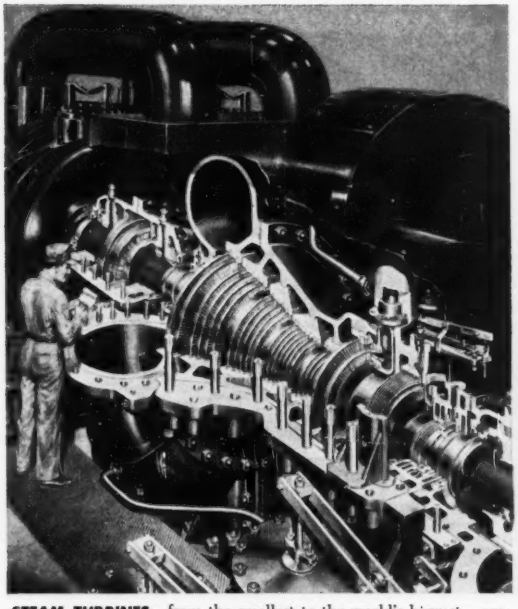
GAS TURBINES—only recently put to industrial use—are proving highly efficient. Socony-Vacuum aided in their development—lubricates the first gas-fired and first coal-fired turbines placed in operation.



HYDRAULIC GIANTS—of type shown—have rotating parts with combined weight and thrust of 250 tons! Microscopically thin films of a famous Gargoyle oil protect these vital parts against damage and wear!

FIRST IN TURBINES

with the Biggest, the Most, the Latest!



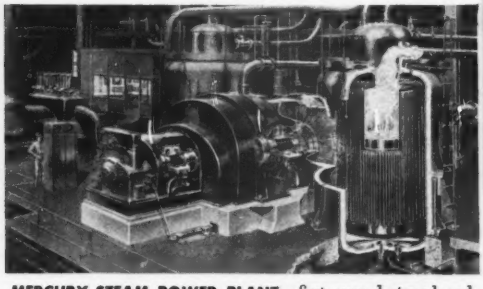
STEAM TURBINES—from the smallest to the world's biggest—are charged with famous Gargoyle oils. In fact, more turbines of 5,000 KW and over are lubricated by Socony-Vacuum than by any other oil company!

Why Accept Anything Less?

Among the many claims made for various turbine oils, one *fact* stands out . . . more turbines of 5,000 KW or larger are lubricated by Socony-Vacuum than by any other oil company! Here's why—

Famous Gargoyle D.T.E. oils are top quality—backed by 85 years of lubrication experience. They protect fully over unusually long periods, give extra long service life, help turbines run more continuously with less need for maintenance.

Why accept anything less for *your* turbines?



MERCURY-STEAM POWER PLANT—first ever designed and coordinated as a unit station—combines two 7,500-KW mercury turbines with a 25,000-KW steam turbine. The entire unit is 100% Gargoyle-lubricated!

SOCONY-VACUUM OIL CO., INC.
and Affiliates:
MAGNOLIA PETROLEUM CO.
GENERAL PETROLEUM CORP.

SOCONY-VACUUM — GARGOYLE Lubricants

SOCONY-VACUUM
Correct Lubrication

WORLD'S GREATEST LUBRICATION KNOWLEDGE AND ENGINEERING SERVICE

Motorola microwave

Multiply your present communication facilities, realize new economies, and make sure of the greatest possibilities for future expansion, by insisting on a MOTOROLA, superior-engineered Microwave System.

With the most *private-owned* microwave mileage now in operation, Motorola offers you the benefit of EXPERIENCE, *plus* many immediate and practical advantages.

Operating in the proven 6000 Mc. frequency band, Motorola Microwave provides maximum effective power gain. The superior frequency-division multiplexing system provides optimum reliability. All your electronic equipment is at ground level for fast, precision maintenance.

Installations

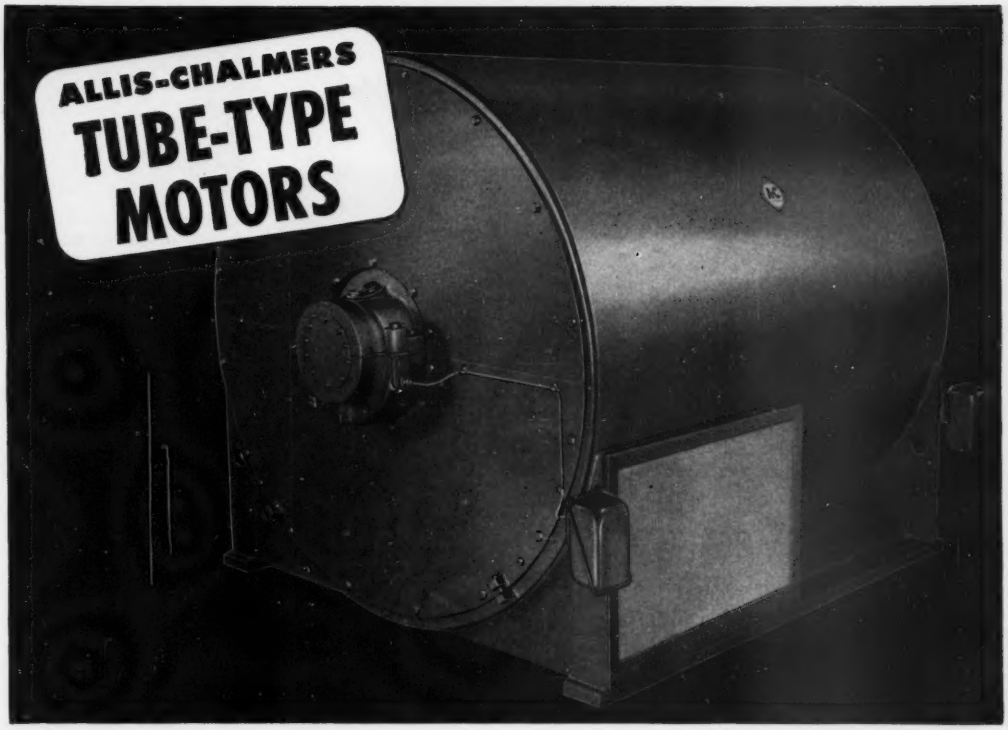
Aeronautical Radio Incorporated
State of California
Pan American Pipeline Co.
Shell Pipeline
Panhandle Eastern Pipeline Co.
Texas Illinois Natural Gas Pipeline Co.
Mid-Valley Pipeline Co.
Brazos River Electric Transmission Cooperative
City of Dayton, Ohio
Michigan State Police

Motorola Microwave is the super communication "pack horse" of complete round-the-clock reliability. Cross-town or cross-country, office to plant—to branch—to mobile crews, it provides multi-channel facilities for voice circuits, supervisory control networks, telemeter, and teletype, 2-way radio tie-in, with innumerable additional combinations for automatically and simultaneously operating your entire system. Motorola Microwave means efficient, economical point-to-point communication.

Motorola COMMUNICATIONS AND ELECTRONICS DIVISION

4545 Augusta Blvd., Chicago 51, Illinois

World leaders in FM 2-way radio communications • 2-way mobile • portable • microwave • carrier and control • supervisory control equipment



Self-Cleaning Motor

Keeps Maintenance Costs Down

MOTOR CLEANING ROUTINE AND COST ARE PRACTICALLY ELIMINATED by the Allis-Chalmers tube-type, totally-enclosed, fan-cooled motor. Even when installed outdoors in contaminated atmosphere, dirt and corrosion cannot harm it.

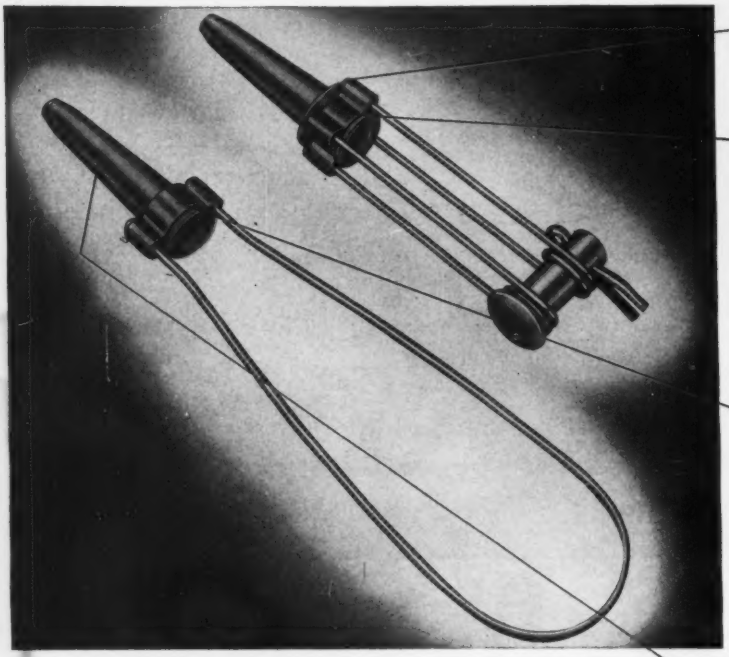
The reason for this outstanding performance is the unique tube-type cooling system. Cooling air circulates through a nest of tubes which surrounds the stator, removing heat from the interior of the motor. The generous flow of air through the straight tubes carries dirt out to the atmosphere. There are no corners or pockets, as in conventional designs, which might collect large dirt deposits. If the tubes ever should need cleaning, a brush on a long handle will do the job in a few minutes.

Sizes range from 75 hp up. Tubes and end plates may be made of special corrosion resistant materials where necessary.

To-day, when manpower is high-priced and getting scarce, cutting maintenance time and cost is more important than ever. Ask your Allis-Chalmers representative to show you how this exceptional motor can reduce your maintenance requirements. Or write to Allis-Chalmers, Milwaukee 1, Wisconsin.
Ask for Bulletin 05B7150. A-3322

ALLIS-CHALMERS

Accents on Accuracy



in the manufacture of

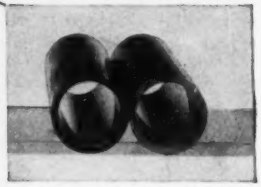
STRAIGHT-THRU DEADENDS

Here is a line of truly corrosion resisting deadends—products that will really last in any climate—at prices no higher than ordinary galvanized fittings. It takes accuracy of manufacture plus ingenuity and economy of design to use the best materials available regardless of cost and make a superior product at a competitive price.

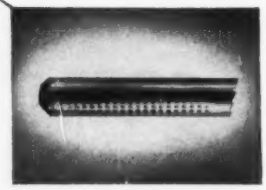
The new type LDS, Long Deadends with the true Stainless bails for disc insulators, and FDS, Flexible Deadends with the true Stainless bails for spool and strain insulators are very light in weight. This reduces vibration fatigue tendencies. They are designed for easy installation and built with ample safety factor, which permits them to do the job both quickly and perfectly.

1. Full strength of bail is realized by tool design that flows steel smoothly into head, strengthening the grain structure.

2. Close control of bronze yoke insures sufficient bearing area against headed bail.



3. Tubing is not only held closely to size, but also to smooth inside finish, because folds or occlusions might hamper perfect performance.



4. Tapers of jaw and tube are accurately limited so wire is not pinched sharply where it enters jaws. This prevents fatigue breakage of wire.

Reliable ELECTRIC COMPANY

3145 CARROLL AVENUE, CHICAGO 12, ILLINOIS

OVER 40 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS
AND
CONSTRUCTION SPECIALTIES

For Trouble Free Installations see that your motor starters carry this Mark of Quality Control

Quality is built into Allen-Bradley Motor Starters in three ways:
1—There are no trouble making gadgets, like pins, pivots, hinges, bearings, or jumpers.
2—The starters are built to precision standards and tested for perfect performance.
3—They are equipped with silver alloy contacts which never need cleaning or filing.

Why not enjoy the continuous production advantages of A-B solenoid motor controls? When you specify motor controls with the well-known A-B name plate, you can feel secure that your plant will not be crippled by costly control failures. Their simplicity is your lifelong guarantee of trouble free service. May we send you a catalog?

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

251-M

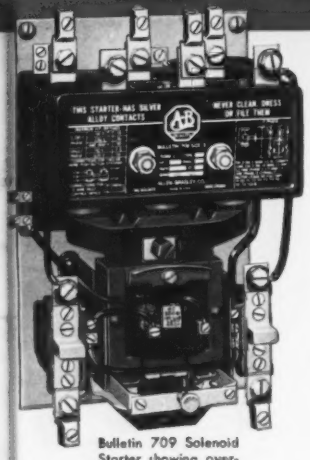
ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

When we say, "NEVER CLEAN 'EM"

We're not kidding



Bulletin 709 Solenoid Starter showing overload relays.

NO CONTACT MAINTENANCE

Here is a line of motor starters that is built for rugged service... without contact maintenance. No insulating oxides can form on the A-B patented contacts. Hence, there is no reason to file or clean these silver alloy contacts and shorten their life. Practical experience has proved that Allen-Bradley solenoid starters are good for millions of trouble free operations ... without any worry about contact maintenance ... even in the toughest industrial service.

EASY TO INSTALL. The Allen-Bradley enameled steel enclosures are designed for easy installation. The white interiors are a patented feature ... they light up the cabinet in dark corners.

There is ample wiring space ... no skinned knuckles trying to run wires into impossible places. Plenty of knockouts, too. Accessible terminals on all sizes. Let us mail you a bulletin.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

All line and load terminals are front connected—they are easy to get at.

There is plenty of space in the enclosures for power and control wires.

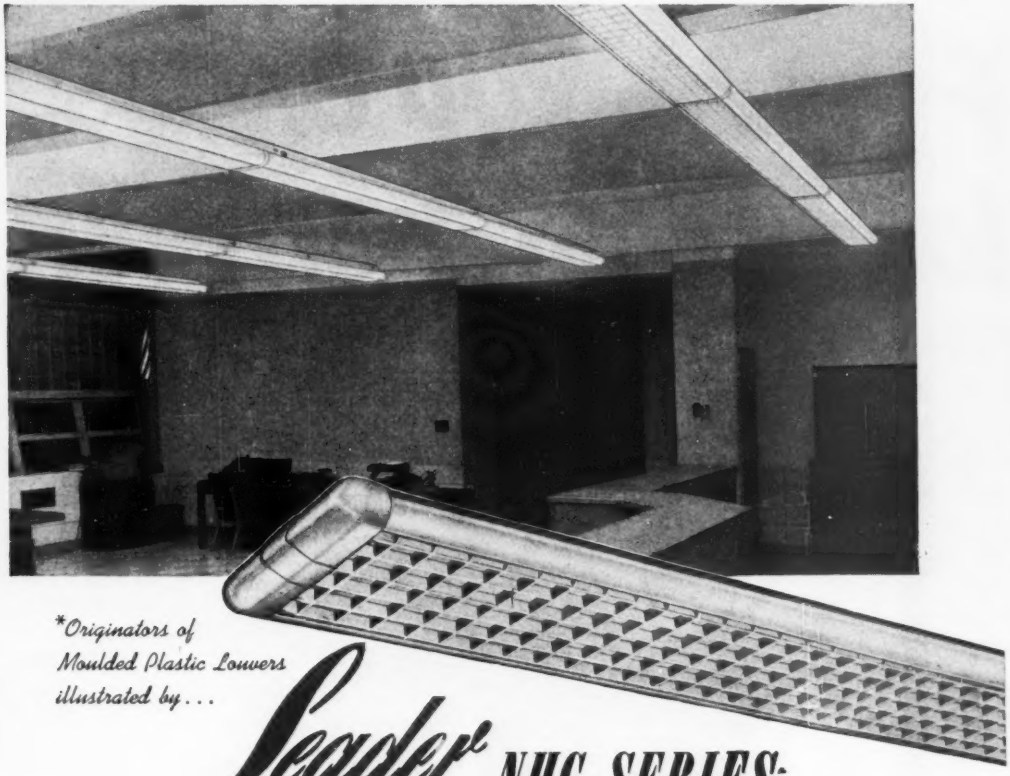
ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

251-M

LEADER*—means fine lighting



*Originators of Moulded Plastic Louvers illustrated by...

Leader NHC SERIES

SPECIFICATIONS

NHC Series
For 2, 3 or 4 Slimline lamps in 48", 72" or 96" length. One-piece louver of injection moulded plastic in choice of 31° or 45° shielding. Plastic is warp-proof, color-fast, "destaticized." Louver swings down to right or left for ease of servicing. Channel of 18 ga. steel. Curved translucent plastic side panels. Deep drawn end caps of 20 ga. steel, beautifully finished.

VL Series
Same specifications as above, but for 2, 3 or 4 40-watt lamps. Optional instant-start.

You'll find Leader's NHC Slimline fixtures installed wherever the demand is for the *finest* in fluorescent lighting—throughout the land in offices, schools, stores, all types of commercial establishments. These trim, slender, beautifully proportioned fixtures add distinction to any decorative effect. Feather-weight moulded plastic louver—*originated* by Leader—"sifts" light rays for pleasing, efficient diffusion. Precision engineering, beauty of appearance, economical performance and ease of servicing combine to make NHC the first choice when the demand is for the finest.

Sold and installed by the better electrical dealers and contractors

Leader America's No. 1 Lighting Equipment Manufacturer

LEADER ELECTRIC COMPANY • 3500 North Kedzie Avenue • Chicago 18, Illinois

Leader Electric—Western: 800 One Hundredth Avenue • Oakland 3, California
Campbell-Leader, Ltd.: Brantford, Ontario • Canada

when you choose an FWD – you choose lower cost per year

YOU CAN RESTORE SERVICE FASTER . . . MEET CONSTRUCTION SCHEDULES. "Weather and terrain are no problem. FWDs go where other trucks won't . . . *work* when others can't. Teamwork is tops because we have *matched combinations* of truck and equipment to fit the job."

YOU GET LOWER MAINTENANCE AND LONGER TRUCK LIFE

"FWD's proper distribution of load and power means less strain. Less strain means longer wear—fewer repairs. FWDs give us up to twice the life of ordinary trucks."

Distributed by Graybar Electric Company

Write Graybar or FWD for facts on the new LD plus data on over 40 different FWD line construction and maintenance units.

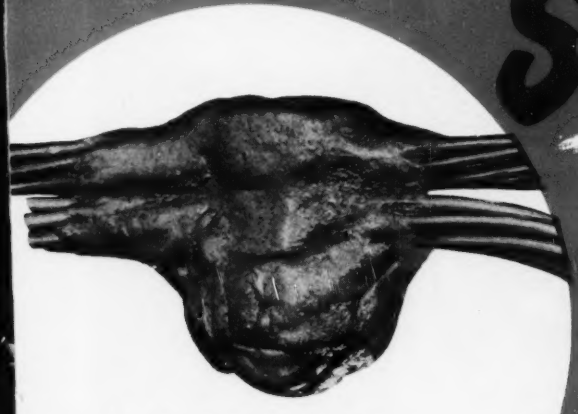
HERE'S A LIGHT-DUTY, TRUE FOUR-WHEEL-DRIVE FOR SMALL CREW UNITS!

Utility after utility is discovering the superiority of this new LIGHT-DUTY Model LD. It is supplied with standardized line construction and maintenance bodies. Find out about this dollar-saving truck today. THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wisconsin, Canadian factory—Kitchener, Ont. *World-Wide Sales and Service.*

Built by the Makers of America's Foremost Heavy-Duty Truck

Clean 'em

WITH A KEARNEY CONDUCTOR BRUSH



Seal 'em

WITH

KEARNEY AIRSEAL

- Seal Out Corrosion
- Eliminate Oxidation
- Insulate for Added Safety

It's the Modern Method of Connection Protection

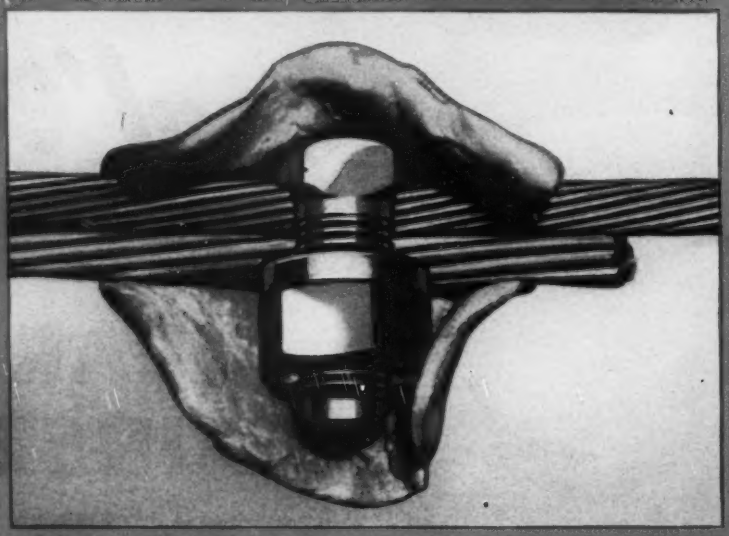
See following pages for more information about this KEARNEY development that is revolutionizing connection protection.

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Ave., St. Louis 10, Missouri
Canadian Plant: Guelph, Ontario

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

For GREATER PERMANENT PROTECTION to ALL CONNECTIONS... use

New KEARNEY AIRSEAL



What Is It?

Kearney AIRSEAL is a pliable, high-dielectric compound, chemically inert which, when applied to connections, forms a *permanent* seal against high resistance contaminations. Its high-dielectric strength (280 volts per mil, laboratory analysis) makes it particularly outstanding as an anti-corrosion agent and as an insulator where safety is an important factor.

CONNECTOR APPLICATION

Easily and quickly applied by moulding around the connector with the fingers. AIRSEAL maintains an efficient, high-conductivity connection because it SEALS OUT contaminating atmosphere.

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

Specify KEARNEY Products...

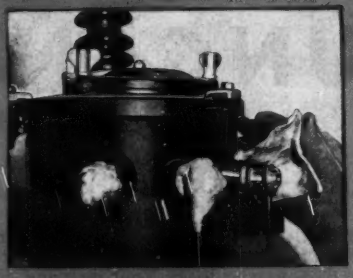
Clean Them First

A clean conductor is essential before making a connection. With a KEARNEY CONDUCTOR CLEANING BRUSH, complete cleaning is a simple operation. The brush is particularly effective for cleaning stranded conductors. A few quick strokes with the "V" shaped brushes thoroughly cleans even the areas between strands. Wire brushes can be rotated in fitting, or replaced when needed.

For live line work brushes are available with universal fitting, as shown, for all spline type poles. Also available with sure-grip wood handle.

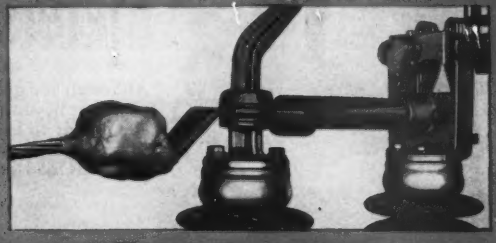
UNDERGROUND CONNECTIONS

The extreme corrosive agents in the earth have made ground connections a hazard to the successful operation of transformers and protective equipment. Because AIRSEAL will not age or deteriorate, even underground, it is ideal for sealing ground connections.



OTHER SUGGESTED APPLICATIONS

(1) Easily applied to irregular contours such as bulky terminal adapters;



(2) Eliminate hazard of accidental contact with transformer secondary terminals — or any other exposed terminal;

(3) Trouble caused by birds and animals on primary terminals of transformers and oil circuit recloser is eliminated when AIRSEAL is applied.

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Ave., St. Louis 10, Missouri
Canadian Plant: Guelph, Ontario

Better Construction— *SAFER* Maintenance

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

171

ADEQUATE WIRING SERVES AND SAVES — THE KEY TO THE MODERN HOME

this load will grow!

100 Ampere 4-2/3 wire service cable installation using a DUNCAN Type D socket and a 15 or 30 ampere meter as the anticipated load growth indicates.

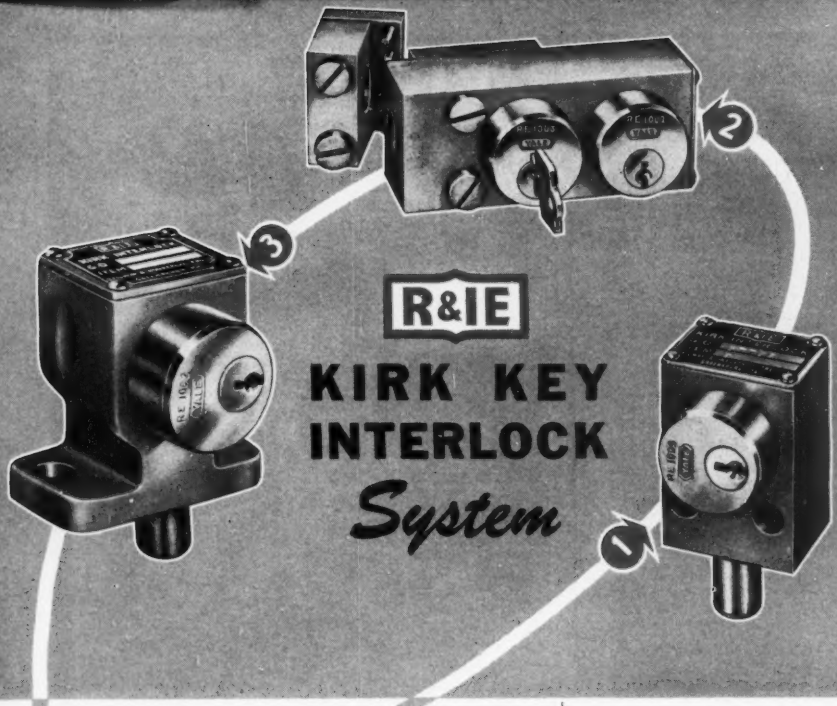
but DUNCAN meters provide for it!

Although the growth of electrical living will increase load requirements far beyond present levels, DUNCAN has designed its metering equipment to handle those heavier loads. Your metering dollar of today enables you to buy equipment with the necessary capacity to meet this load growth. Duncan Electric Mfg. Co. Lafayette, Ind.

makers of watthour meters for fifty years

DUNCAN

METERING EQUIPMENT FOR AN EXPANDING INDUSTRY



R&IE

KIRK KEY INTERLOCK *System*

KEY . . . YOUR OPERATIONS FOR SAFETY

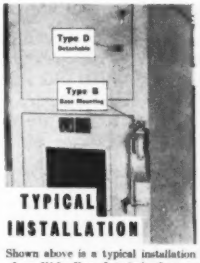
Kirk Key Interlock Systems prevent the authorized person from doing the unauthorized thing! Added safety for your installation and equipment is provided by this device which is applied to two or more movable parts, preventing or allowing movement of one part only when another part is locked in a predetermined position. Unlimited operating schemes can be arranged in electrical installations, processing systems, fluid and pneumatic systems, etc., from combinations as shown, or multiple units of any one of them. Individual locks are mechanical and meet basic mounting requirements. Following are descriptions of the 3 types shown above:

1. **TYPE F**—For flat mounting—Can be mounted on any protective device.

2. **TYPE D**—Detachable....Can be mounted on cell door, gate or compartment. One key retained with door locked open....other key can be retained by operator or used to operate other devices.

3. **TYPE B**—For base mounting—Can be mounted on handle of disconnecting device....Key released when lock is open.

Please write for Bulletin No. 1725 for full description, applications and typical schemes for R&IE Kirk Key Interlocks



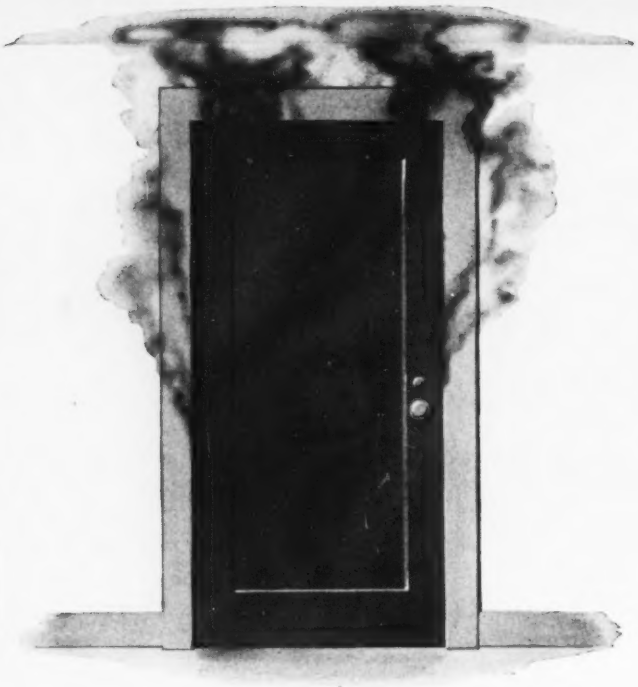
TYPICAL INSTALLATION

Shown above is a typical installation of a Kirk Key Interlock System. Fuse compartment can only be opened when interrupter switch is locked open.

RAILWAY and INDUSTRIAL ENGINEERING CO., Greensburg, Pa.
IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO
AN I-T-E SUBSIDIARY

The Check List

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- HORN GAP SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- DISTRIBUTION EQUIPMENT
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SWITCHING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES



Where is the safest place to keep your documents?

Are your contracts, blueprints, accounts receivable—the records that keep your business going—really safe?

If you've ever seen business papers charred by fire . . . or made illegible by water from fire fighting, you'll want to make sure it can't happen to your records.

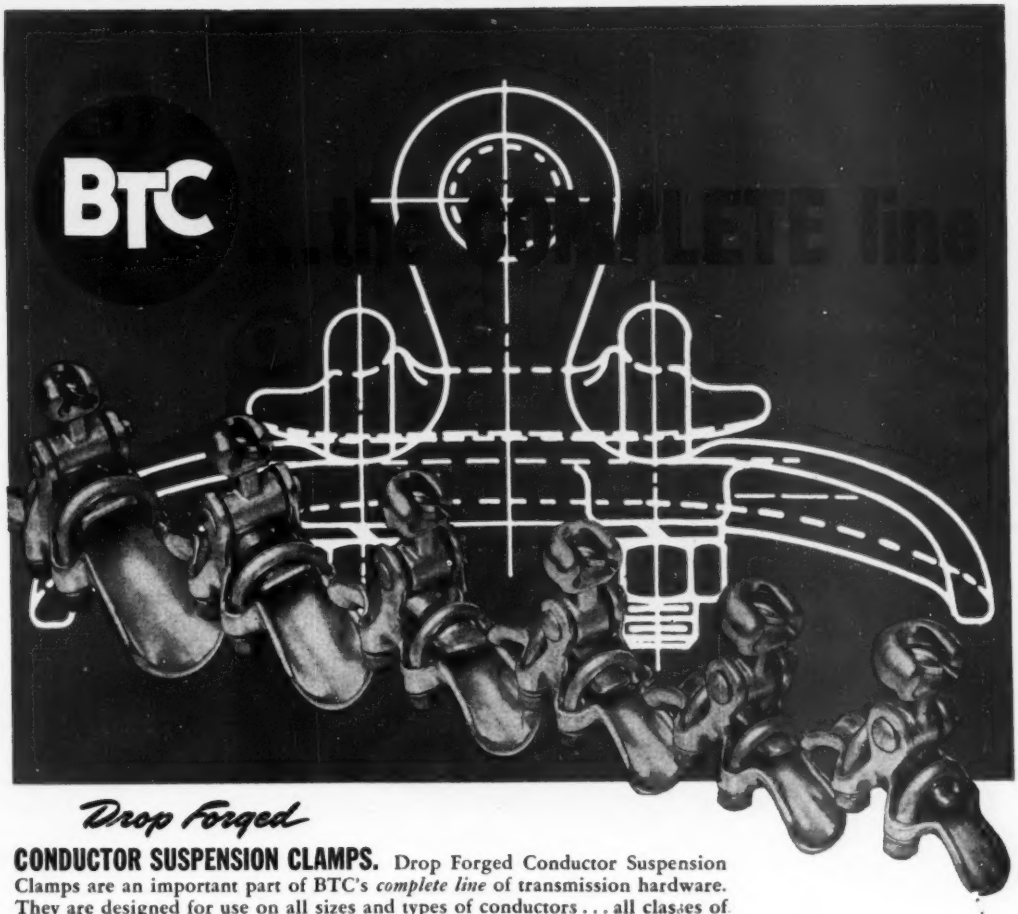
Wherever you store these papers, you can rely on a *Kidde* Fire Extinguishing System to protect them. A Kidde System uses carbon dioxide—a gas that won't mark, stain or discolor papers—and it puts out fire *fast*.

You can put a Kidde system on guard over one or many record vaults . . . ready at the first sign of flame to release a fire-smothering cloud of CO_2 . . . and do it *automatically*.

Why not go *all the way* in protecting your papers. Call a Kidde expert for full information.

Kidde

Walter Kidde & Company, Inc., 430 Main Street, Belleville 9, N. J.
In Canada: Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.



Drop Forged

CONDUCTOR SUSPENSION CLAMPS. Drop Forged Conductor Suspension Clamps are an important part of BTC's *complete line* of transmission hardware. They are designed for use on all sizes and types of conductors . . . all classes of construction . . . all voltages . . . all line current loads . . . and all conditions of atmospheric corrosion.

These clamps are noted for their superior strength and resistance to shock and fatigue, their lasting reliability in service, as well as all of the properties inherent in drop forged metal parts. A wide range of sizes allows the choice of exactly the right clamp for your particular conductor.

Drop Forged Steel Clamps. Hot-dip galvanized series, suitable for all conductors. 6200A Series — Envelope Type. 7200 Series — Trunion Type.

Drop Forged Stainless Steel Clamps. BTC's 6200A and 7200 Series can be furnished in Non-Magnetic Stainless Steel, combining corrosion-resistance with minimum power loss and cool operation.

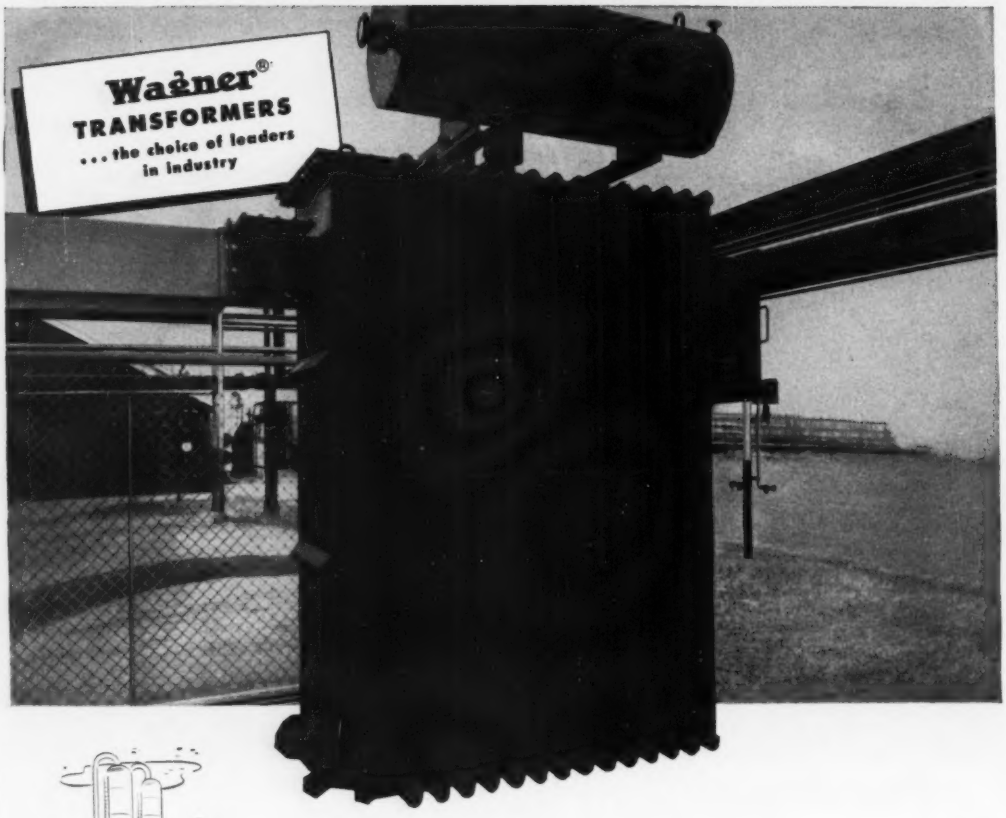
NEW M.P.L. SUSPENSION CLAMPS. BTC's new series of Minimum Power Loss Conductor Clamps minimize hysteresis and eddy current effects . . . conserve marketable power . . . eliminate heating, annealing and weakening of clamped section of the conductor . . . improve corrosion resistance.

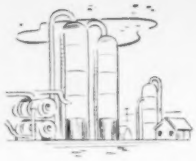
Drop Forged Heat-Treated Aluminum Alloy Clamps. Designed for A.C.S.R. and Aluminum Conductors. 9500 Series M.P.L. Clamps — Envelope Type.

Drop Forged Aluminum-Silicon-Bronze Clamps. High strength, zinc-free alloy with excellent resistance to corrosion. Designed for Copper, Copperweld and Copper Type Composite Conductors. 9700 Series M.P.L. Clamps — Envelope Type.

Sold through your insulator manufacturer only.

Write today for your copy of BTC's new Hi-Line Hardware Catalog which tells the complete story.





here's dependability at work!

This 2500 kva, 3 phase, 60 cycle Wagner Unit Substation Transformer is located in the high pressure division substation of the modern Ponca City Refinery of Continental Oil Company. It is throat-connected by means of weatherproof bus duct to switchgear located in an adjoining building and feeds all of the electrical load associated with the thermal cracking units and delayed coking units of this refinery. A power interruption of only a few minutes would completely disrupt this important processing and cause a shutdown of the entire refinery.

Wagner transformers are often found, furnishing *dependable* power, in spots where failure would incur great cost because they have a reputation for unfailing dependability—backed by sixty years of transformer building experience.

Bulletin TU-181 tells the complete story of Wagner Power and Substation Transformers. Write for your copy.

Wagner maintains 31 branch offices, located in principal cities, for quick, convenient engineering service and consultation. Call your nearest branch for competent advice on your next transformer installation.

Wagner Electric Corporation
1891 WE 1951

TU-9

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

BLACKBURN *Hi-Strength* CONNECTORS

Make BETTER Connections — HIGH PRESSURE Connections!

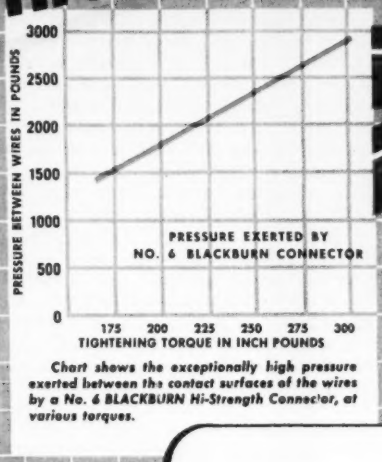
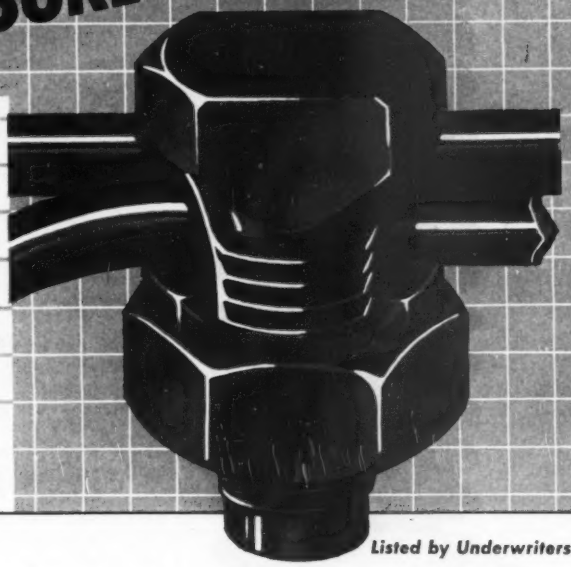


Chart shows the exceptionally high pressure exerted between the contact surfaces of the wires by a No. 6 BLACKBURN Hi-Strength Connector, at various torques.



Listed by Underwriters

HIGH PRESSURE Connections Are BETTER Connections

High pressure increases the contact area between the wires, effectively seals the contact surfaces from moisture and oxidation, and produces a lasting, low-resistance connection.

BLACKBURN Connectors Make Lasting High Pressure Connections because:

(1) They are made with the right combination of alloys — high strength alloys — to reduce frictional losses in the threads.

(2) They are made with smooth-cut threads, to increase their efficiency. These two factors insure more of the tightening torque being converted to "pressure between wires".

(3) Their corners and edges are all rounded, so that the high pressure cannot injure the wires.

(4) They actually test stronger than other connectors when pulled to destruction in a tensile-testing machine. This means that BLACKBURN Connectors have that extra strength required to maintain the high "pressure between wires" without stretching and loosening.

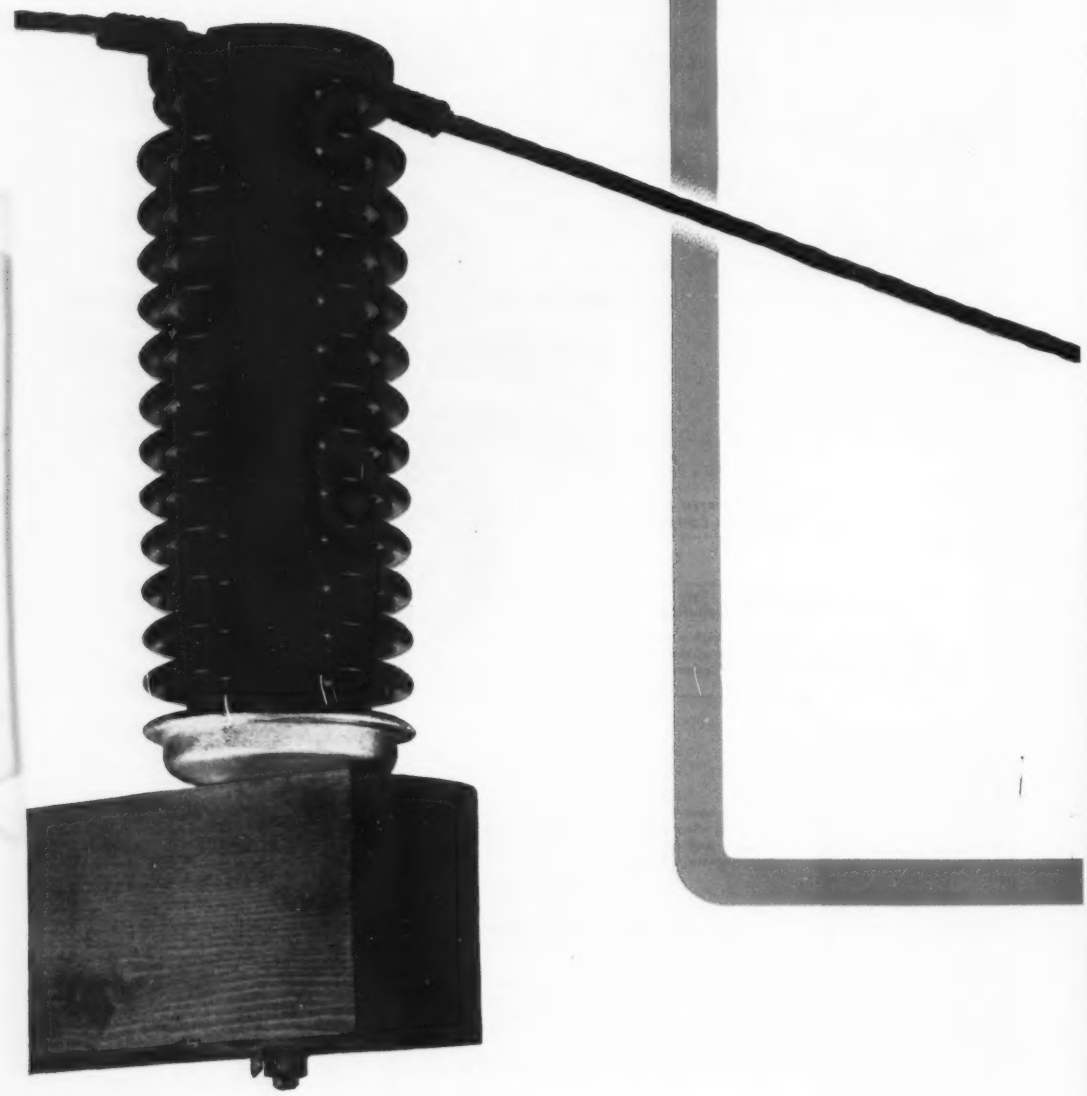
(5) The coefficient of expansion of the alloys used is substantially equal to that of copper. A temperature change of 100° F results in only 1% change in the "pressure between wires".

Yes, BLACKBURN Hi-Strength Connectors definitely make *better connections — for your protection!*

JASPER BLACKBURN CORPORATION

Builders of Quality Connectors for 15 Years • 35 Madison St., St. Louis 6, Mo.
Phone CEntral 3007

DID



YOU SAY, "COME BACK IN 20 YEARS"?

When we introduced the Lapp Line Post, we were confident that its revolutionary new design was matched by a revolutionary new order of performance . . . that for power transmission it would provide an *extra* margin of operating security—electrically and mechanically.

We showed our new development to engineering and operating men in power companies across the land. We had back of us a good record of sound ceramic production, and we offered an engineering conception that added up to an amazing combination of characteristics. And most of the places we went we got an answer that boiled down to : "Looks good—almost too good. That makes it suspicious. Let's see how good it looks after 15 or 20 years of service."

That was in 1931. Now we're back, with 20 years of service to substantiate our claims. For in spite of a natural skepticism, we did get more and more Line Posts in service. At the beginning, most of them in "trouble spots," where lightning conditions were so bad . . . or the Kids such good marksmen . . . or salt fog or industrial contamination so persistent . . . or radio interference such a problem . . . that operating people were ready to "try anything."

How's the record? Our original claims are still good. No radio interference . . . no puncture . . . no cracking . . . no cleaning . . . greater resistance to stones and bullets . . . better performance under arcover. And, with 20 years to establish our right to these claims, a new one which sums them all up: *Lines on Lapp Line Posts have fewer outages, require fewer insulator replacements, and less maintenance than comparable lines on any other type of insulator.*

If you held off on the "untried" Line Post design, it's because you wanted to be *certain* about performance of the insulators on your lines. That makes you the fellow who should be most anxious to take advantage of the operating superiority of the *proved* Line Post design. It will make quite a difference in your company's operating and maintenance costs over the next 20 years.

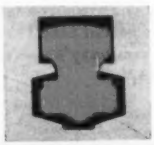
Lapp

BURNDY-BUILT *to do an important job* BETTER

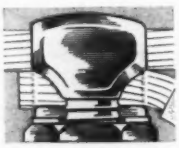
Comparison of Burndy Servit with other makes, reveals some striking advantages. The longer Servit head is easier to hold with a wrench. The pressure bar equals the length of the head and contributes much to Servit's higher pull-out strength. Servit is forged from high-strength silicon bronze alloy to afford exceptional durability without bulk. Furthermore, all Servits will give good results in service. Strict quality control on daily production runs keep Servit performance characteristics at a uniformly high level.

MORE CONVENIENT! — Won't stick up like sore thumb! Easier wrench grip!

SMALLER! — Servit shown against another split-bolt of comparable size.



BURNDY SERVIT

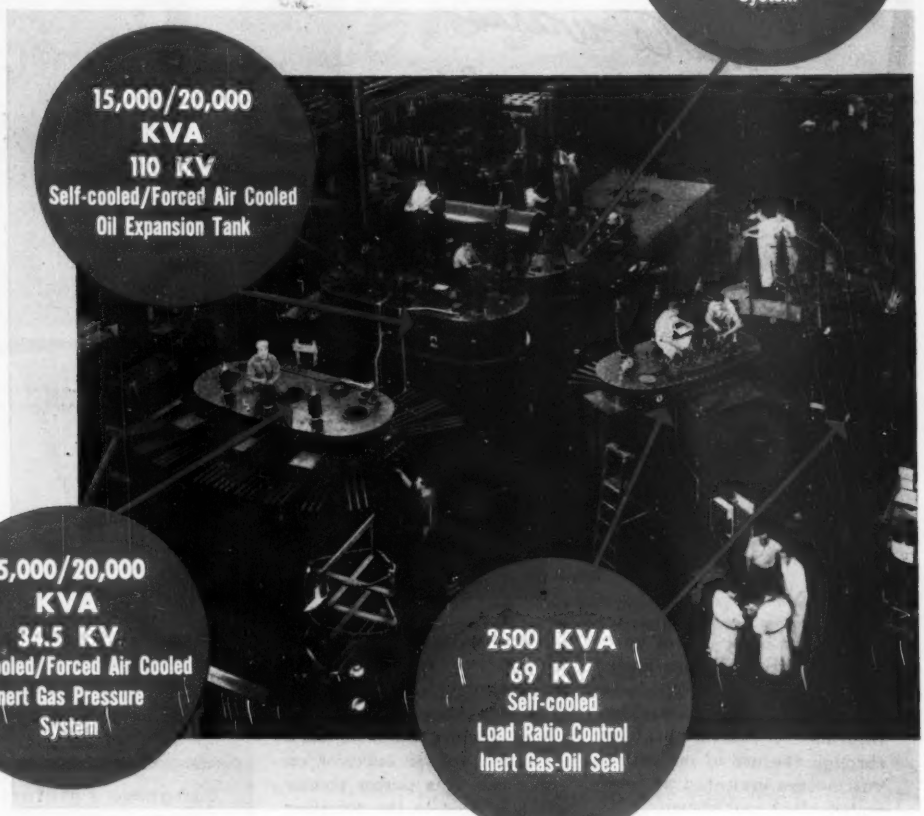


STRONGER! — Head and pressure bar of equal length — bar resists crushing!

TIGHTER! — Maximum tightening force transmitted into intimate contact between conductors.

BURNDY, New York 54, N. Y.
Western Branch: Vernon 58, Calif.
Burndy Canada Ltd., Toronto 8, Ontario

POWER TRANSFORMERS assembled HERE..



This section of the Pennsylvania plant is known as the Finishing Department. All Power transformers stop here for final assembly and finishing before going to the Test Department.

The group of transformers pictured is representative of the types of Power transformers designed and manufactured by Pennsylvania.

Transformers in this group range from 2500 Kva to 30,000 Kva. Some are equipped with no load tap changers; others with underload tap changers.

Many types of cooling methods are represented — self-cooling, forced air cooling, and forced oil cooling.

Methods of oil preservation include Inert Gas-Oil Seal, Oil Expansion Tank, and Inert Gas Pressure Systems.

Other Power transformers regularly built by Pennsylvania have ratings up to 100,000 Kva and voltages up to and including 230 Kv.

Pennsylvania TRANSFORMERS **Pennsylvania TRANSFORMER COMPANY**

CANONSBURG, PENNSYLVANIA • *Greater Pittsburgh District*

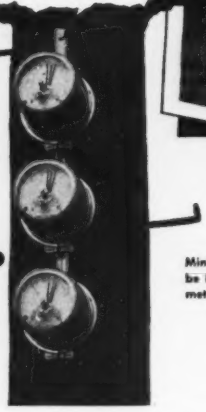
Here's How

You can get more watts out of your copper—

This Photo Courtesy of Gulf States Utilities Company, Baton Rouge, La.

LINCOLN MINIMAX INDICATING VOLTMETERS

...the *Low Cost* way to obtain continuous voltage information



MiniMax Voltmeters can be installed in standard meter sockets.

To get the most out of your copper, correct voltage levels must be maintained on the basis of *continuous information*. This information can be obtained through the use of indicating voltmeters mounted at load centers along your system.

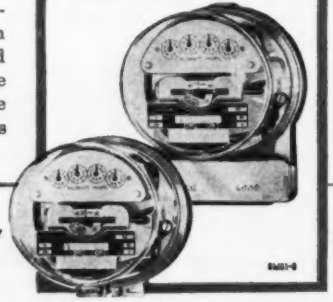
Lincoln MiniMax Indicating Voltmeters provide the most economical way to get the information you need for setting voltage regulators and for solving other voltage control problems. They make the use of graphic meters unnecessary in most cases, and permit inexpensive, *permanent* installations that save the valuable man hours required to make periodic surveys.

The MiniMax voltmeter is equipped with a minimum and a maximum voltage indicator on either side of a pusher pointer which is fixed to the actuating element of the meter. The pointer spreads the indicators apart with changes in voltage. These indicators show the 10-minute averages of minimum and maximum voltages which have occurred since the last resetting. The pointer shows the average voltage at any time. The MiniMax is time lagged so that instantaneous values are not shown.

Bulletin 483 gives full information . . . write for your copy today.

Sangamo J Meters

These watthour meters meet today's requirements and tomorrow's anticipated loads with sustained accuracy, economy of maintenance and troublefree performance.



Only Measured Facts are Known Facts

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

EXPERIENCE + { MODERN FACILITIES / MODERN METHODS / MODERN THINKING

MEANS "It MUST Be Right!"

Triangle's two plants—one making wire and cable in New Brunswick, New Jersey, the other making conduit in Moundsville, West Virginia, have kept pace through the years with every advancement and are completely modern in machinery and equipment.

When it comes to wire, cable or conduit, you want assurance that it's *right* — right in quality, right in performance. Triangle products are right! Triangle's *long experience* coupled with modern machinery, modern methods and modern thinking means "*It Must* Be Right!"

Triangle products are built to the highest possible specifications under the supervision of craftsmen who take pride in surpassing accepted standards.

Experience plus modern facilities, modern methods, modern thinking — that's why Triangle can say with confidence — "IT *MUST* BE RIGHT!" That's why you can specify Triangle and know that "IT *IS* RIGHT!"

THIS MAN WANTS TO HELP YOU!

He is your Triangle Distributor. In the same way Triangle offers quality *products*, your Triangle Distributor offers unexcelled *service*. See your Triangle Distributor *first*. In the long run you'll save and get it faster, from a Triangle Distributor.

THE TRADE-MARK OF TOP QUALITY!

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

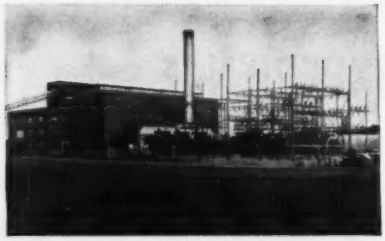
IT MUST BE RIGHT

"Glazon" Building Wire • "Glazon" Non-Metallic Sheathed Cable • Armored Cable • Service Entrance, Service Drop, Varnished Cambric Braided or Leaded, Trioprene Trench, Power and Parkway Cables • Bare Wire • Rigid Conduit Hot-Dipped Galvanized • Electric Metallic Thin Wall Conduit • Flexible Steel Conduit

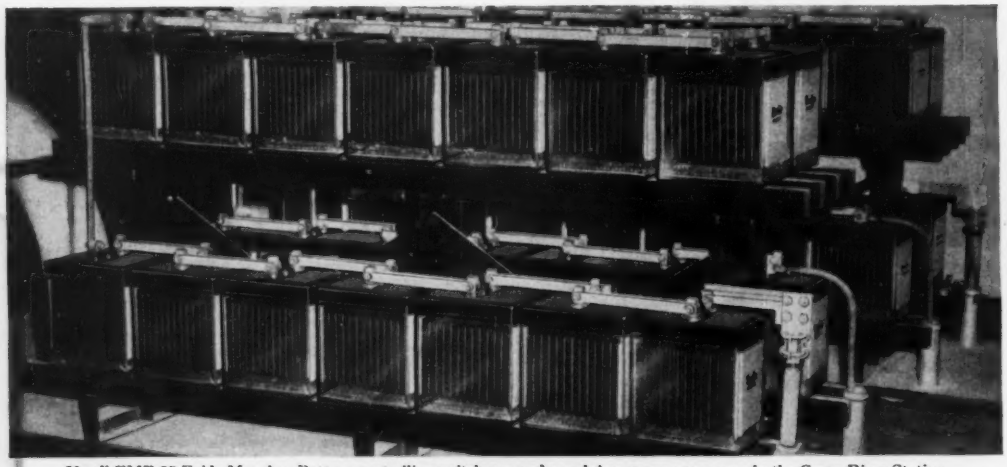
Exide-Manchex

provides the dependability needed by this Station Duty Cycle

Green River Power Station uses 60-cell Exide-Manchex to control switchgear, to supply power for emergency lighting, alarms and communication systems



Kentucky Utilities Company
Green River Power Station, Central City, Ky.



60-cell EME-25 Exide-Manchex Battery controlling switchgear and supplying emergency power in the Green River Station.

The Green River Power Station, a modern base load plant of the Kentucky Utilities Company, utilizes two 30,000 KW turbine-generators. It supplies power for important communities and industries in the surrounding territory through three radiating 33 KV lines, two 66 KV lines, and one 138 KV line.

The station battery—a 60-cell EME-25 Exide-Manchex—is used as a source of supply to trip and to instigate the reclosing action of seven 66 KV and four 33 KV oil circuit breakers. These are pneumatic closing, with the battery supplying power to operate the air valve which closes the breaker. Inside the plant are 31 air circuit breakers operating at 2.4 KV. These breakers are also controlled by the Exide-Manchex. The air breakers control all motors of 100 H.P. and up; all station auxiliary power. And when all else fails, a battery-operated motor-driven oil pump maintains pressure in the hydrogen oil-seal system.

Besides the switchgear control, the Exide-Manchex supplies power for 14 KW of emergency lights, which are on a throw-over switch; all alarms in the station system; and, in emergencies, all communication systems through a rotary converter.

All these duties are performed dependably—economically—by the Exide-Manchex Battery. Use Exide-Manchex in your station: For positive operation of switchgear; for an adequate and uninterrupted supply of current for all your stationary battery requirements. Exide-Manchex is your best battery buy!

ONLY EXIDE-MANCHEX BATTERIES GIVE YOU ALL THESE FEATURES:

- Exclusive long life manchester positive plate.
- Slotted plastic separators, impervious to chemical and electrical reaction.
- Plastic spacers for plate alignment.
- Latest development in molded glass jars for compact installation.
- Heavy terminal posts with copper inserts for extra conductivity to give instant high discharge.

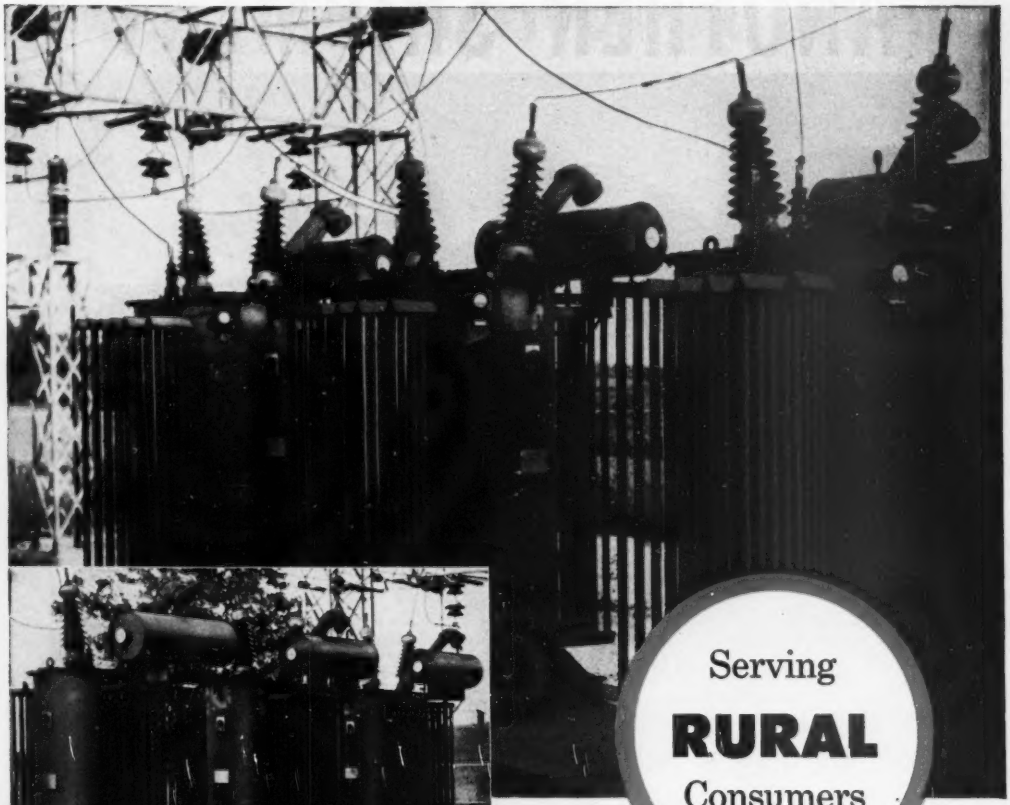
THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 2

Exide Batteries of Canada, Limited, Toronto

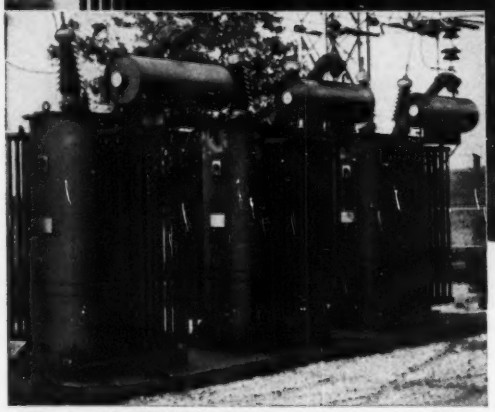
"Exide" and "Manchex" Reg. Trade-marks U.S. Pat. Off.

1888 . . . DEPENDABLE BATTERIES FOR 63 YEARS . . . 1951

Uptegraff POWER Transformers



Serving
RURAL
Consumers



● Two views of a 2500 KVA substation, serving rural consumers. The installation consists of three 833 KVA Uptegraff Power Transformers, OISC, single phase 66,000 volts to 7200/12470 Y volts.

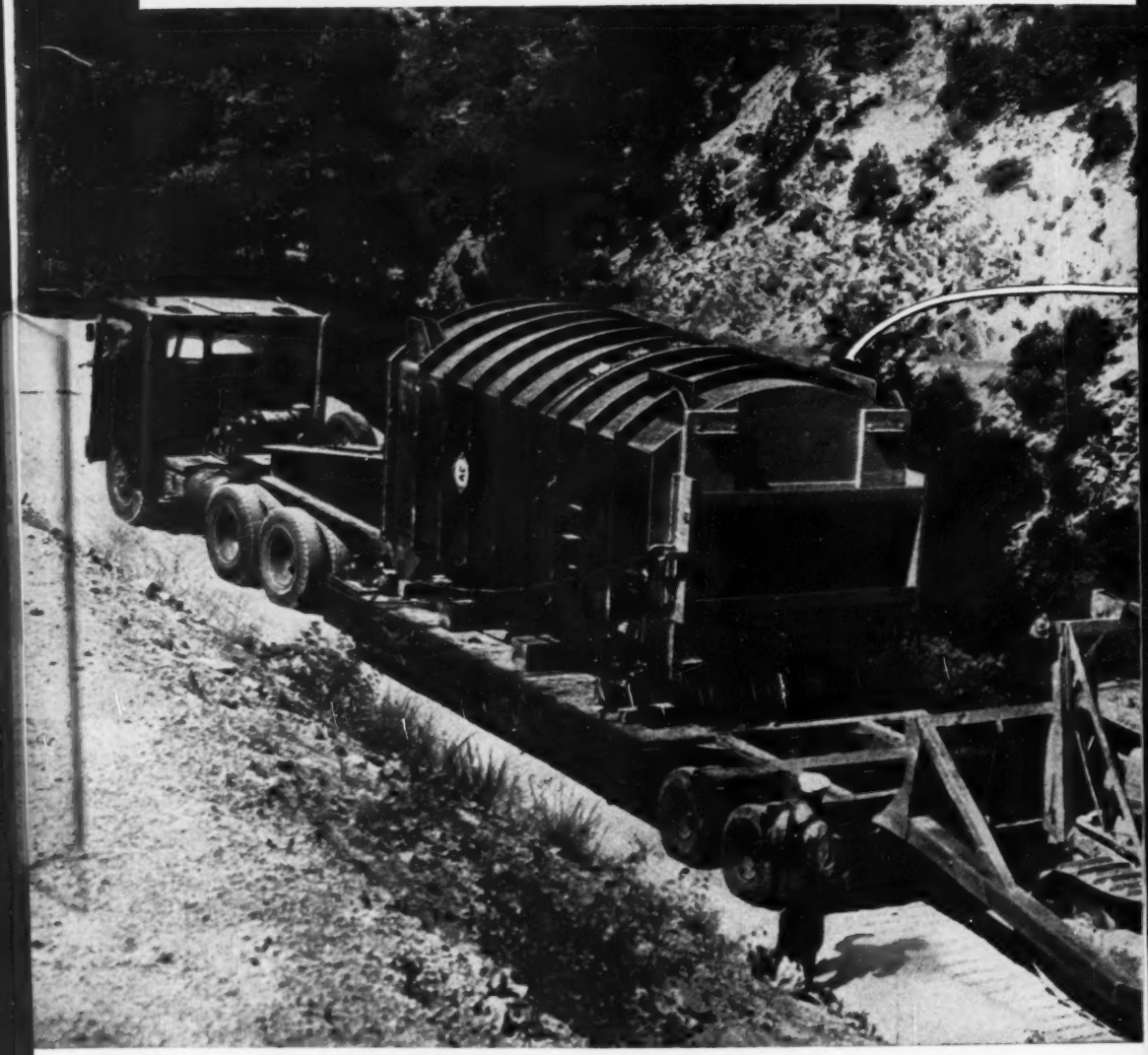
Where transformer dependability is essential to continuity of service, you can rely upon the built-in quality of Uptegraff POWER Transformers. This has been amply demonstrated by the operating records of Uptegraff Transformers in numerous rural systems.

Design and construction details reflect extensive experience and skill in the manufacture of transformers. Uptegraff versatility and manufacturing flexibility permit the prompt delivery of transformers made to meet *your* particular requirements.

Uptegraff Power Transformers are made in sizes up to 10,000 KVA, 69 KV for indoor or outdoor service.

R. E. UPTEGRAFF MANUFACTURING COMPANY
SCOTTDALE, PENNA.

ANOTHER SHIPMENT OF



Shown here is the first of four Allis-Chalmers corona-free transformers being delivered to Pacific Gas and Electric Company's Cresta Power Station in the Sierra Nevada mountains. All four transformers are shell type and are rated 25,000 kva, 240,000/11,500 volts.

ALLIS-CHALMERS

Corona Free TRANSFORMERS

RECENTLY, THE PACIFIC GAS AND ELECTRIC COMPANY boosted the capacity of its transmission system with four Allis-Chalmers corona-free transformers. And because these transformers are free of the destructive effects of corona, they will stay young for years!

Internal corona discharge has been a frequent cause of transformer failure. It shortens transformer life by attacking insulation, causing a gradual weakening of transformer impulse strength.

Allis-Chalmers engineers set out to eliminate corona right at the source — sharp corners and other places of high voltage stress. Their oscillograms indicated when and where corona was occurring. By rounding and shielding vulnerable parts of terminal boards and by redirecting dielectric fields, they "knocked out" injurious corona. Then, with the help of calculating boards, they analyzed transient phenomena, thus enabling them to locate critical areas and replace free space with corona-resisting material.

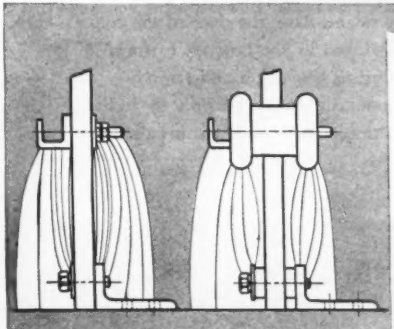
Results: Allis-Chalmers transformers are now completely free of corona. They retain their full impulse strength even after repeated surges from lightning or switching. Allis-Chalmers, Milwaukee 1, Wis.

A-3335

A-C ALLIS-CHALMERS

1. CALCULATING BOARD helps engineers solve complex transformer problems and makes possible detailed analysis of transient phenomena. Transformer equivalent circuit is set up on the calculating board for initial voltage measurements. From readings obtained the amount of insulation required at every point in the transformer is determined.

2. IMPULSE WAVE is examined by engineer J. H. Moran during voltage distribution test. Transformers receive a reduced voltage test when partially assembled. Full test voltages are applied to the finished transformer, using the oscilloscope as a further check on calculating board figures. Voltage measurements are carefully checked.



3. Electrodes in immediate contact with an insulating panel submerged in oil tend to develop corona and streamers that flash to ground.

The *before* and *after* sketches shown indicate what has actually been done to make these high voltage units completely safe from stresses. Tap changers can now do their work without danger of breaking down after countless lightning or switching surges have struck the transformer.

Another Cut in Cost—

of voltage regulation for rural loads

Testing and servicing are made easy by control cabinet with door hinged at bottom to form a "workbench"—and by easily removable flexitest drawout-type relay chassis.

New dollar-saving advantages have been added to the URL-8 Feeder Voltage Regulator. *Testing and servicing are now made easier, faster.*

A new package control permits removal of the entire assembly as a unit—in the field—for testing or repair. Or a stand-by unit can be inserted in a matter of seconds. Mounted in a drawout-type flexitest case, it facilitates quick testing, repair or replacement. Also, the door of the control cabinet is hinged at the bottom, to form a "workbench" during inspection and servicing.

Single-pole mounting, made possible by lightweight construction, results in lower installation costs. Simple, direct drive tap changer cuts maintenance. The characteristics of the voltage-regulating relay assure close regulation. Separate resistance and reactance line drop compensation is adjustable by individual dials.

Get complete information from your nearby Westinghouse representative, or write for Catalog 47-430. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70586

YOU CAN BE SURE.. IF IT'S
Westinghouse

VOLTAGE REGULATORS

"SEEING EYES"

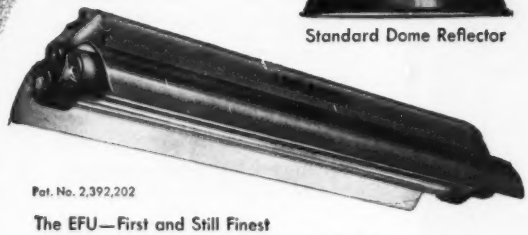
for PROFITABLE PRODUCTION

Without good clear vision on the job, even the most skilled production worker falls short of top performance. That's why good lighting equipment is a basic essential for consistently profitable production. Appleton Lighting Fixtures provide the *right* light, without uncomfortable glare, troublesome contrast or shadow. Each type is a model of mechanical simplicity—economically installed, easily wired, conveniently serviced.

Products of more than a half century of experience, Appleton Lighting Fixtures are made to suit every industrial requirement—including hazardous locations—whether indoors or out. For the finest illuminating equipment or expert assistance on any lighting problem, contact Appleton—Standard for Better Lighting.

Industrialite High Mounting Fixture
For High Bay Interiors

Standard Dome Reflector



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The EFU—First and Still Finest
Fluorescent Explosion-Proof Lighting Fixture

Two sizes: for two 40 Watt, 48" Lamps
or two 100 Watt, 60" Lamps.

Pat. No. 2,530,135

Type EVX Vented
Explosion-Proof Fixture

Available for 60, 100, 150, 200, 300 and 500 Watt Lamps.

Standlite—for Filling Stations, Parking Areas

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Resident Representatives: Binghamton, Dallas, Indianapolis, Kansas City, Orlando, Milwaukee, New Orleans, Seattle, Portland, Ore.
Export Representatives: International Standard Electric Corp., 67 Broad St., New York 4, N. Y.

APPLETON

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

These tubes go in to stay!

Thanks to CHASE ANTIMONIAL ADMIRALTY

(a patented alloy)

Here's the reason why Chase Antimonial Admiralty* keeps condenser tubes on the job year after year:

They've got *enough* antimony to resist dezincification. And antimony will not affect the metal's grain structure and won't weaken the tube.

When you get Chase Antimonial Admiralty Condenser Tubes, you're getting metal that *stays tough* . . . stands up under heavy stresses . . . lasts for years.

Years of use have proved Chase Antimonial Admiralty's superiority.

*U. S. Pat. No. 2,061,921

Special stocks of
ANTIMONIAL ADMIRALTY
Condenser Tubes in Chase Warehouses:
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also carried by—
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Chicago	Houston†	Newark	Rochester†	
Cincinnati	Indianapolis	New Orleans	St. Louis	

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THE MOST CHALLENGING FLUORESCENT LIGHTING OFFER EVER MADE!
Try 24 Sylvania Fluorescent Tubes of any popular type. If they don't give more light and maintain color and brightness for a longer time than any other brand, send them back and your money will be refunded.
SYLVANIA ELECTRIC

A wow of an idea that sells Sylvania Tubes by the case

Now your customers can buy Sylvania Tubes in lots of 24 or more with the understanding that these tubes have got to be *the best* . . . or customers get their money back.

That's the substance of the most dramatic and compelling fluorescent lighting offer ever made.

Today this offer is being placed before millions of readers in big, smashing, full-page ads in *Time, Business Week, Newsweek, Today's Business,* and *Electrified Industry. Also* in *Chain Store Age, Purchasing,* and a large group of *important industrial magazines.*

In addition, the nation-wide TV show "Beat the Clock" is broadcasting Sylvania's great offer to prospects everywhere.

So get in those Sylvania Tube orders now. Stock up and follow up, and you'll be sure to *clean up!* For full details, see your Sylvania Representative or mail the coupon NOW!

Sylvania Electric Products Inc.
Dept. L-7104, 1740 Broadway
New York 19, N. Y.

Please send me new folder explaining Sylvania's remarkable fluorescent lighting plan.

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SYLVANIA ELECTRIC

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TODAY
IS THE TIME TO SELL TOMORROW'S CUSTOMER!

*Automatic Clothes Dryer Saturation: less than 2%

*Automatic Clothes Washer Saturation: less than 10%

*Rotary Ironer Saturation: less than 9%

*Food Freezer Saturation: less than 8%

*Dishwasher and Disposall® Saturation: less than 2%

Hotpoint is taking the lead to raise today's low saturation appliances* to the level of broad public demand. This, plus Hotpoint's *leadership* in today's demand appliances is of special importance to utilities, because it means *load insurance* for the future . . . for the day when wider usage of major electric appliances will be needed to build and balance load.

HOTPOINT Looks at Tomorrow, *TODAY*

UTILITY DIVISION
Hotpoint Inc.
(A General Electric Affiliate)
5600 West Taylor Street, Chicago 44, Illinois

NOW! LOCKE BRINGS YOU THIS SIMPLE, PRACTICAL METHOD FOR REDUCING POLE LINE HARDWARE STOCKS

Locke's RM* Handylog . . . a compact, easily-used book . . . contains complete information on all the standard Pole Line Hardware you need. It's the perfect working partner for the man who's out to SIMPLIFY his inventory of Pole Line Hardware.

Helps win battle against rising costs and material shortages—By concentrating your planning and purchasing on Locke RM* hardware items, you stock fewer items, only fast-moving items. This enables you to reduce the over-all dollar value of your inventory. You also sharply reduce storage requirements.

RM* items in good supply—All Locke RM* Hardware items are mass-produced. They're regularly in production at the factory . . . and more quickly obtainable than specials from your Locke Regional and Distributors' warehouses.

RM* (Repetitive Manufacture) — A program designed to help reduce the installed cost per kilowatt on line and station equipment.

Locke RM* Handylog only guide of its kind—Only Locke provides you with this guide to simplification of hardware stocks. If you haven't got a copy, write for one today. Use it . . . place the items you find in it on your standards list. You'll be taking the only real short cut toward the big money-saving, time-saving benefits many utilities today enjoy as a result of their efforts to simplify hardware stocks.

LOCKE
INCORPORATED
BALTIMORE, MARYLAND

Before you buy (stop!) **See what Locke's Got!**

Portrait of man saving money

A Kaiser Aluminum triplex service drop cable means material and installation cost savings of 20 to 40 per cent.

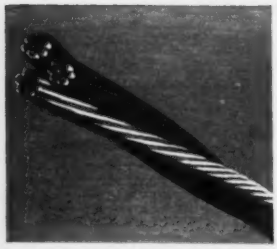
It needs two-thirds fewer accessories. Takes fewer man hours to install. And its strength and reduced weight permits it to be strung for longer distances.

For these money-saving reasons, select Kaiser Aluminum triplex cable for your service drops.

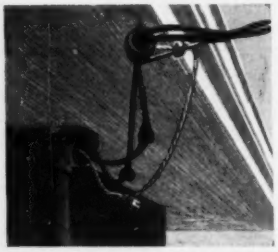
Defense requirements necessarily limit the supply but there will be enough in time for everyone.

For we are producing at full capacity and we are expanding facilities to make possible a vast increase in the supply of primary aluminum.

Meanwhile, to get *all* the facts about Kaiser Aluminum triplex cable, call any office listed below.

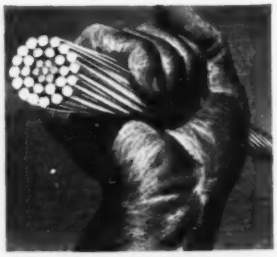


THREE-IN-ONE—Kaiser Aluminum triplex cable combines three wires in *one* assembly—two neoprene or polyethylene covered wires and one bare neutral as messenger.



FEWER ACCESSORIES—Triplex cable requires only one insulator house knob. It eliminates festooning, and reduces cluttered appearance.

ANOTHER MONEY-SAVER—Kaiser Aluminum Weatherproof Wire—neoprene or polyethylene covered—costs less than copper, gives years of trouble-free service!

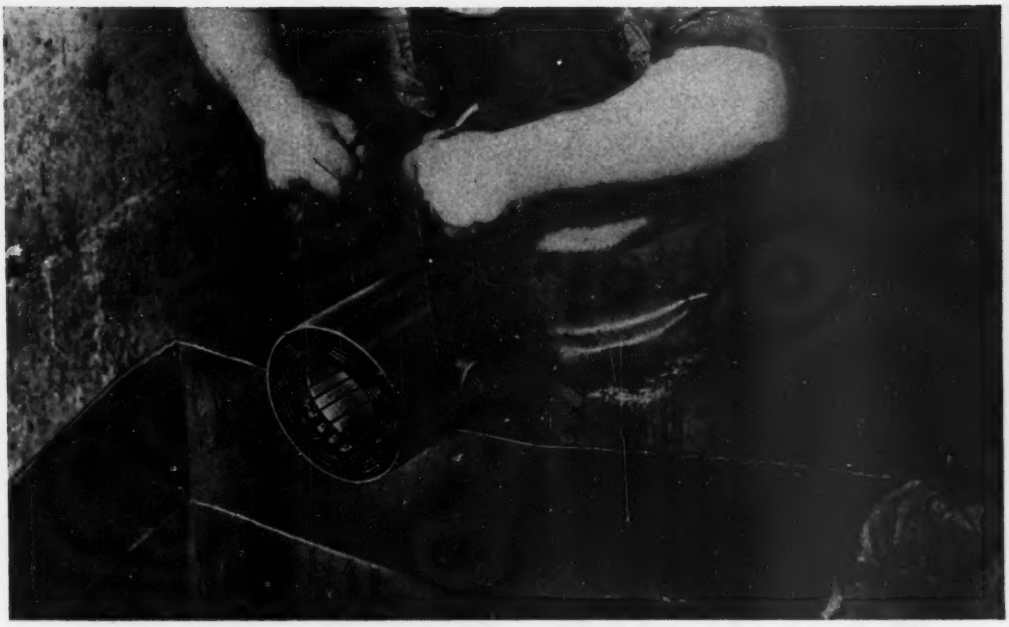


AND ANOTHER—Same cost advantages with Kaiser Aluminum ACSR. Reasons why more than 80% of all transmission lines being built are aluminum!

Kaiser Aluminum

Setting the pace . . . through quality and service

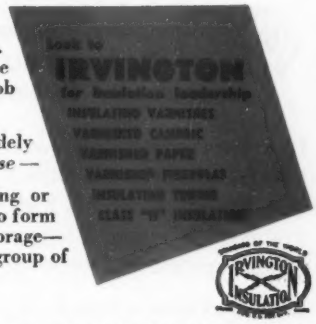
SOLD BY KAISER ALUMINUM & CHEMICAL SALES, INC., KAISER BUILDING, OAKLAND 12, CALIFORNIA
OFFICES IN: Atlanta • Boston • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit Houston • Indianapolis • Kansas City • Los Angeles • Milwaukee • Minneapolis • New York Oakland • Philadelphia • Portland, Ore. • Rochester, N. Y. • Seattle • Spokane • St. Louis Wichita • EXPORT OFFICE, OAKLAND, CALIFORNIA • DISTRIBUTORS IN PRINCIPAL CITIES



"For high temperature service at low varnish cost, OUR CHOICE IS HARVEL 612-C"

Mr. R. Mowery, Chief Engineer of DeWalt Inc., manufacturers of world-famous woodworking machines, tells *why* his company has been using Harvel 612-C Insulating Varnish *consistently* since 1936:

"We have to have a varnish that stands the high temperatures under which our motors must operate. The varnish must retain adequate flexibility to prevent cracking under severe service conditions. Thinning solvents used for the varnish must not affect the motor insulation. Harvel 612-C is absolutely the best varnish we can buy at the price to meet these requirements. Any other varnish that will do the job would cost us twice as much."



Harvel 612-C is *one* of the Irvington internal curing varnishes widely used by makers of motors and other electrical equipment *because* —

They *cure throughout* by polymerization—no risk of softening or throwing out at high speeds and temperatures. They *cure fast* to form firm, tough coatings of high strength. They are stable in storage—stable in service. Get the *full* story on the advantages of this group of Harvel Varnishes—just mail the coupon below.

Send this convenient coupon now

Irvington

VARNISH & INSULATOR COMPANY

6 Argyle Terrace, Irvington 11, New Jersey

EWO 4/51

Irvington Varnish & Insulator Co.
6-C Argyle Terrace, Irvington 11, N. J.
Gentlemen:

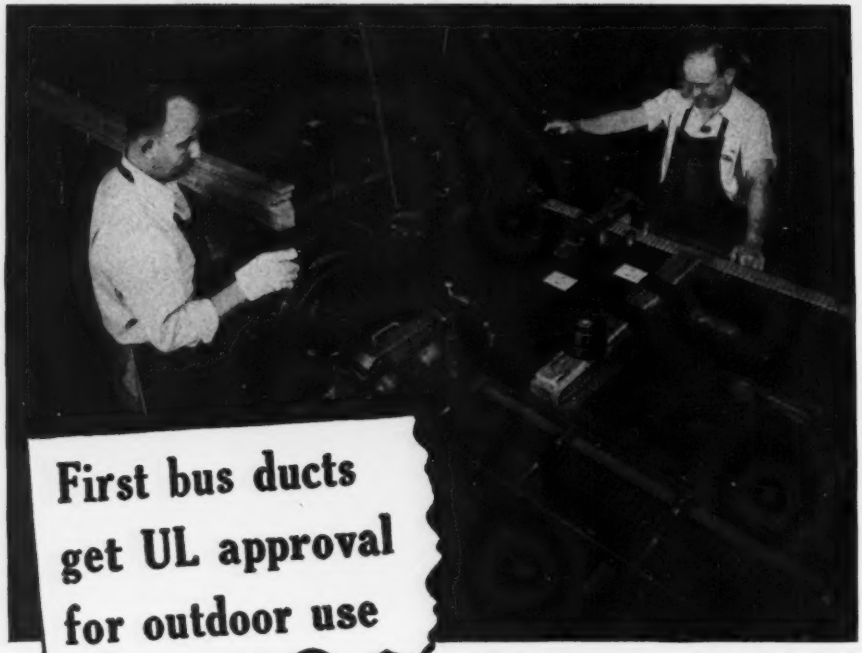
Please send me your bulletin on Harvel Internal Curing Insulating Varnishes.

Name..... Title.....

Company.....

Address.....

City..... State.....



First bus ducts get UL approval for outdoor use

...with bus bars wrapped in weather-proof plastic TAPE!

New bus ducts of Bulldog Electric Products Company, Detroit, Mich., get the first approval of Underwriters' Laboratories for outdoor use — or for any *wet* or damp location!

Bus bars of the approved construction are wrapped in "SCOTCH" Electrical Tape No. 22. Previous insulating material was difficult to handle and apply. New tape is mechanically wrapped on straight lengths up to 15 feet — gives excellent appearance and performance.

When you need a tape to resist moisture, alkalies, acids and oils try "SCOTCH" Electrical Tape No. 22. Dielectric strength is over 10,000 volts. Plastic backing stretches snugly around odd shapes. Stick-at-a-touch adhesive gives moisture-tight seal — keeps weather out, prevents corrosion. Write Dept. EW451 for illustrated booklet giving you all the facts.

ANGULAR PIECES of bus bars are hand-wrapped with "SCOTCH" Electrical Tape No. 22. Half lap gives positive protection. Tape is easy to apply — even around curves, uneven surfaces. Available in 36 yard rolls and in standard widths of ½, ¾, 1 and 2 inches. Wider tape can be supplied to order.

The term "Scotch" and the plaid design are registered trade-marks for the more than 100 pressure-sensitive adhesive tapes made in U. S. A. by **MINNESOTA MINING & MFG. CO.**, St. Paul 6, Minn. — also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: Minn. Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N.Y.

You said it...

...We did it!

We designed ELEMEX capacitors to give you what you need!

Utility men with ten to fifteen years of field experience knew pretty well what they needed and wanted in capacitors. Just about ten years ago L-M began its capacitor design and in 1944 began producing capacitors incorporating some of these user-ideas.

ELEMEX capacitors have an excellent service record. Rate of failure has been low; performance has been consistently good—so good, in fact, that we have never completely caught up with the demand for more and more ELEMEX capacitors.

Here are some of the things you said you wanted in a capacitor, and what L-M has done about it.

1. Long life: L-M's low unit insulation stress, individual evacuation, capillary impregnation and many in-process tests have assured a very long life and freedom from trouble. We're proud of our performance record! Over 99.44% of all ELEMEX capacitors manufactured over a 7-year period are still in operation. That is a failure rate of less than 1/10% per year!

2. Strong solder-sealed bushings: L-M developed a new, stronger method of solder-sealing. L-M tests 100% of its bushings and seals. Actually, it takes 1900 pounds to force an L-M bushing out of the cover! Also we've got higher creepage distance, unbreakable terminal caps.

3. Pure aluminum electrodes: Not just tinned copper—but pure aluminum.

4. Simple, easy installation: We designed them with uniform terminal height above mounting flanges, gave you "Paragroove" connectors which simplify wiring.

5. Low-cost maintenance: L-M introduced stainless steel tanks and will *continue* to produce them as long as Type 304 is available. (Incidentally, this forced down the price of mild steel units, which saved you money on *both* types!) L-M mild steel tanks have *three* coats of enamel, each *baked* separately, not just one or two spray coats.

6. Streamlined tanks: Large-radius rounded corners make ELEMEX tanks smooth, give improved appearance, and extend paint life. Sharply sheared edges always corrode first.

7. Convenient, sensible packaging: In sturdy, wood reinforced sealed cartons. Full identification printed on sides and ends of carton, with the serial number repeated on the top of the carton for the convenience of the storekeeper. Painted surfaces subject to abrasion in shipment are protected with wax paper. Only L-M packs its 2 and 4 unit hangers in individual cartons to simplify handling for you.

8. Simple low-cost switching: L-M's new Voltage-Sensitive Control gives you accurate, dependable switching at a cost low enough to permit its use even with small capacitor banks.

Want to cut line losses? Reduce wattless current on your lines? Get capacitors that stay on the job? Ask the L-M Field Engineer for full information on ELEMEX capacitors; or write Line Material Company, Milwaukee 1, Wis. (a McGraw Electric Company Division).

LINE MATERIAL... Capacitors

Complete Coordinated Equipment for Distribution Today

Life Insurance
for line-type arresters

WE'VE MADE THEM LAST LONGER
WITH THESE L-M FEATURES

Capacitance type spark gap maintains consistently low sparkover

Accurately shaped heavy alloy disc electrodes help assure uniform sparkover. These discs are separated by special ceramic spacers with silvered faces. These form a simple, effective voltage divider of the capacitance type which maintains uniform voltage distribution in the gap and protects it from stray electrical fields and the effect of snow or water on the housing. The ceramic spacers have a dielectric constant about 400 times that of the usual ceramic spacers. Dividing the gap into two short sturdy sections at top and bottom of the arrester increases mechanical strength.

Lens-shaped electrodes lengthen life of characteristic element

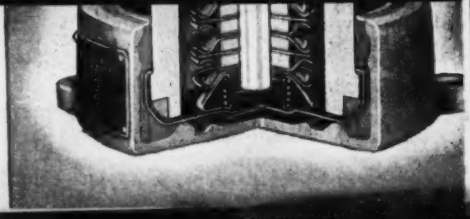
Like alternating current in a conductor, lightning surge current tends to "skin" down the outside of the arrester valve element. This "skin effect" characteristic lowers the surge capacity of ordinary arresters because only a small portion of the valve element cross-section area is used to handle lightning current. However, in L-M's Line Type Arresters, lens-shaped metallic electrodes shorten the electrical distance down the center of the valve element just enough to counteract the skin effect. The surge discharges evenly all through the valve element—and the arrester lasts far longer. The arrester can take *more* heavy surges . . . it maintains its high discharge capacity without change for years and years.

LM®

LINE MATERIAL ... Lightning Arresters

Complete Coordinated Equipment for Distribution Today

L-M type DL Line Type Arresters are available in 8 sizes from 20 to 73 kv, are heavily built, have many features to assure adequate protection with unchanging characteristics for a long, long time. Get Bulletin LA4; it gives you the whole story. Ask your L-M Field Engineer for a copy, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



37

This wedge blows out the arc

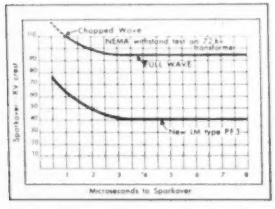
How L-M's arc-switching principle makes L-M expulsion arresters LAST LONGER!

Cross section of fibre arcing plug, showing wedge-shape arc-switching chamber.

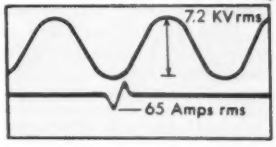
When a surge sparks over in an L-M type PF3 lightning arrester, the arc first jumps the short gaps at *A* (in the cutaway view). Since the arc is in the narrowest part of the wedge-shaped arcing chamber, gas instantly forces the arc over into a long, thin shape at *B*—then blows it out the bottom vent. Fast and sure, it operates in half a cycle or less.

The arc barely touches the electrodes before it's over and out. It doesn't last long enough to burn electrodes or fibre, so the arrester has a long, dependable, trouble-free life.

Better get the whole story from your L-M Field Engineer. Or write for Bulletin LA-3—address Line Material Company, Protective Equipment Division, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



New lower sparkover level of the 9 kv type PF3 compared with the NEMA minimum standard impulse strength of a 7200 volt transformer. (Other ratings show comparable margins of safety.)



Here a 35000 ampere surge was put on a 7200 volt line with 1200 amp fault current capacity. Because of gas pressure built up by this high surge, the arrester drew only 65 amps follow current, and cut that off in 1/10th cycle. The PF3 also amply meets accepted NEMA standards for lightning arrester performance. Now in seven ratings—3, 6, 9, 10, 12, 15 and 18 kv.

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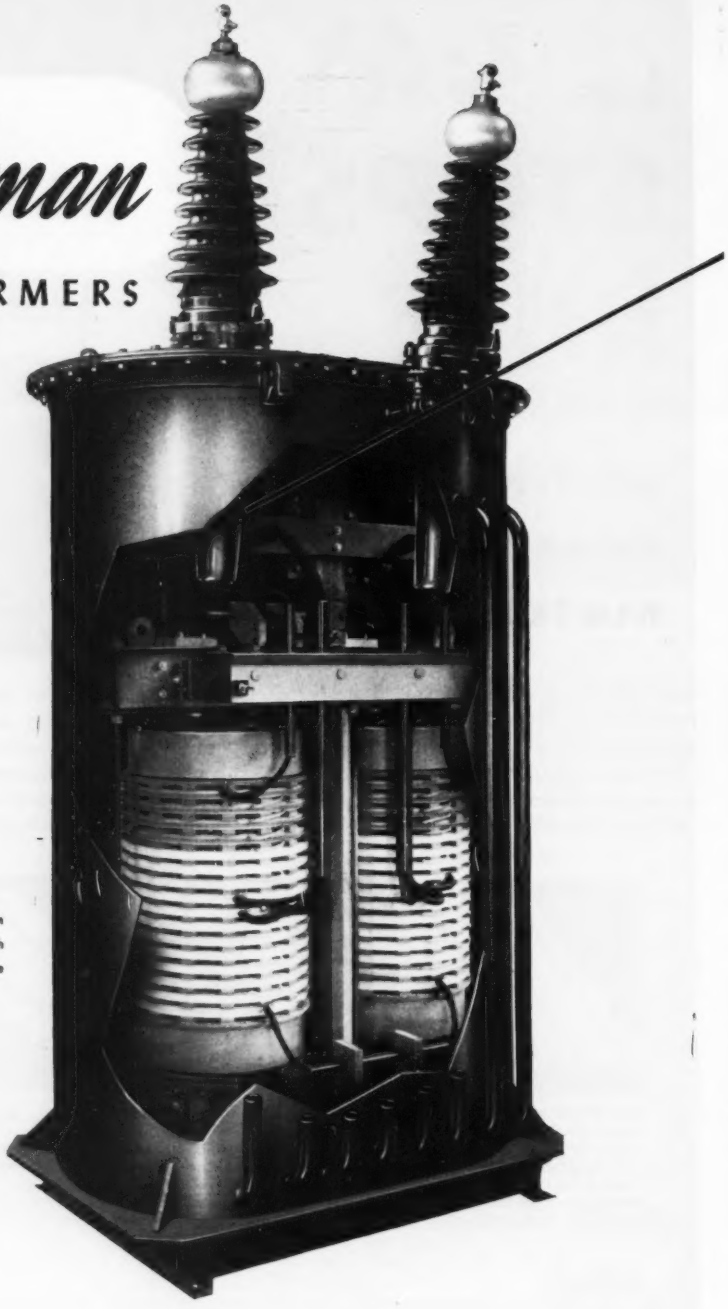
LM®

LINE MATERIAL ... Lightning Arresters

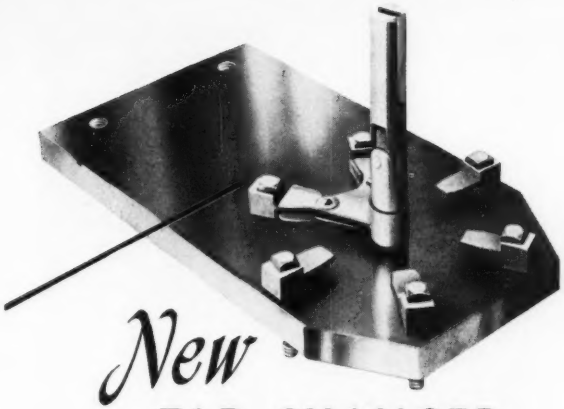
Complete Coordinated Equipment for Distribution Today

Kuhlman

TRANSFORMERS



Core type 333 KVA Kuhlman distribution transformer, high voltage 67000, low voltage 2400.



New

TAP CHANGER

HAS IMPROVED CURRENT CARRYING CAPACITY, ...IS SELF-CLEANING

Improved current carrying capacity and self-cleaning of contact blades are major features of this new Kuhlman tap changer, now standard equipment on all Kuhlman transformers 167 KVA and above, single phase, and 225 KVA and above, three phase. These important advantages are achieved by self-aligning spring clips on rotary blades which engage heavy stationary blades, providing positive double surface contact under substantial pressure. High creepage resistance and permanent alignment of contacts is assured by the use of a special low power factor non-warping phenolic laminate in the tap changer board.

This is another example of Kuhlman's restless engineering talent, which is continually on the outlook for new methods, new features, new materials. Some other famous Kuhlman Firsts: the Bent Iron Core, pioneer of the wound core types; the oil impregnation of transformer coils; the use of varnish in place of compound impregnation materials; the developing of the forerunner of the present day series multiple transformer; the clamp type bushing terminal which eliminates use of tools in making primary connections.

All of these Kuhlman developments have been adopted in one form or other by progressive transformer manufacturers. Kuhlman is proud of this fact, feels it is a tribute to its engineering genius and manufacturing inventiveness. It's an indication, too, of the type of product you get when you specify Kuhlman transformers.

Kuhlman ELECTRIC COMPANY

BAY CITY, MICHIGAN

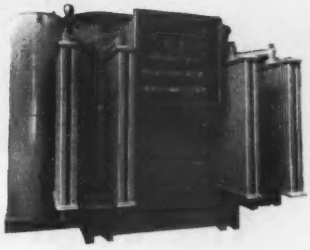
Export Representatives:
International Standard Electric Corporation
67 Broad Street, New York 4, N. Y.
Cable Address, Microphone, N. Y.

A complete transformer line for ALL your needs. Write for new Kuhlman bulletins on Distribution, Power, Dry Type, Street Lighting and Specialty units.

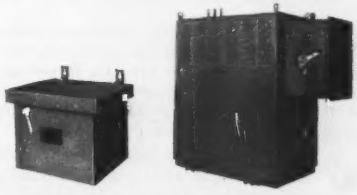
A KUHLMAN TRANSFORMER FOR YOUR EVERY NEED!

KUHLMAN CONVENTIONAL TRANSFORMERS

KUHLMAN CSP TRANSFORMERS

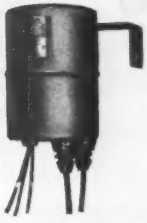


KUHLMAN POWER TRANSFORMERS



KUHLMAN DRY TYPE TRANSFORMERS

KUHLMAN SAF-T-KUHL TRANSFORMERS



KUHLMAN STREET LIGHTING TRANSFORMERS

103

The Control Center that OUTSMARTS ACCIDENTS

No longer is it necessary to expose personnel to "hot" buses or to sacrifice safety to gain accessibility to your control centers. Removal and replacement of Westinghouse Starter Units is safe and simple. "Magna-Grip" stab connectors simply "plug-in" to the power bus.

To work on the panel, starter unit may be withdrawn to a tilt-out disconnect position and locked. The unit is "dead" . . . completely disconnected from the power bus and self-supporting in this position. Protection is assured since it is impossible to reach around the starter unit and touch the bus.

For work on the bench, it is a simple matter to remove the complete starter unit. Note that the *unit door remains on the panel* so that it can be closed to guard the exposed bus. Rigid guide rails in the structure facilitate replacement of the starter unit. These rails align the starter and steer the "Magna-Grip" stab connectors into accurate contact with the power bus.

Westinghouse Control Centers offer still more points of safety.

For example:

Complete baffling to localize unusual arcing if faults occur.

Interrupting capacity of each starter not less than 15,000 rms amps.

Self-cooling construction for foolproof ventilation.

Sturdy structures that are self-supporting.

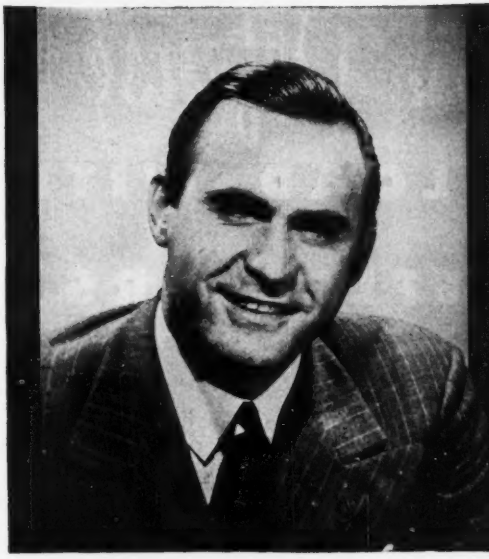
Get all the facts as presented in booklet B-4213 from Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-27008

YOU CAN BE SURE . . . IF IT'S Westinghouse

DESIGN TESTED AND VERIFIED IN THE Westinghouse HIGH POWER LABORATORY

WESTINGHOUSE

CONTROL CENTERS



HERE ARE Down-to-Earth Reasons WHY I SPECIFY ORANGEBURG

—Says the Utility Engineer

In plain language this is what the Utility Engineer means. Orangeburg Conduit provides a *permanent* cable raceway *underground.* It will not corrode, lasts indefinitely. Its impermeable wall and tight joints prevent corrosive ground waters from entering. Orangeburg lays faster at lower cost. Protects cable sheath from abrasion when pulled in—also from wear during cable movement due to alternate expansion and contraction with changing loads. Resists acids, alkalis, grease, oil. Orangeburg Conduit is tough, durable and resilient—will not crack or break when properly handled.

PROTECTION . . . POWER . . . PRODUCTION

They are big words under today's conditions because permanently protected cables keep the *power* flowing and the *production* up to essential volume. The Utility Engineer appreciates the close connection between cable *health* and community *wealth.* Orangeburg is a magic name . . . and has been for 58 years . . . with public utilities and municipalities . . . because the lasting protection that Orangeburg Conduit gives electrical services underground assures uninterrupted power for all users of electricity.

Orangeburg saves money, too, by faster and easier handling, tooling and laying . . . and by supplying a complete line of delay-preventing standard fittings for conduit. Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.

ORANGEBURG STANDARD

. . . installed with concrete encasement. The *preferred* conduit for banks of three or more ducts.

ORANGEBURG NOCRETE

. . . installed without concrete encasement. Its extra heavy wall makes NOCRETE practical for many single or double duct runs.

ORANGEBURG FIBRE CONDUIT

STANDARD Installed with Concrete

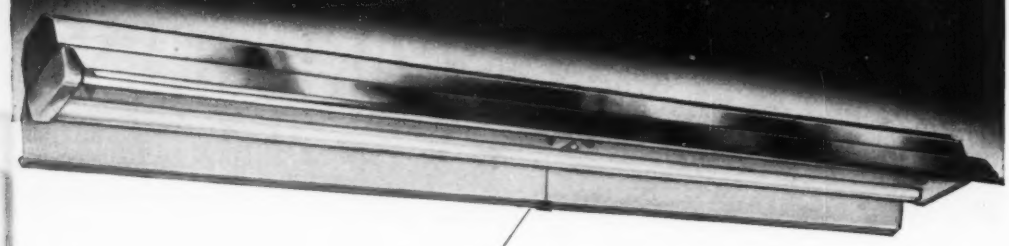
NOCRETE Installed without Concrete

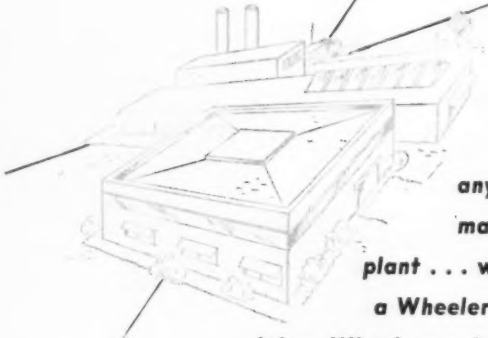
GENERAL ELECTRIC SUPPLY CORPORATION

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

GraybaR ELECTRIC COMPANY

LIGHTEN YOUR *Defense* PRODUCTION LOAD WITH *Wheeler* REFLECTORS





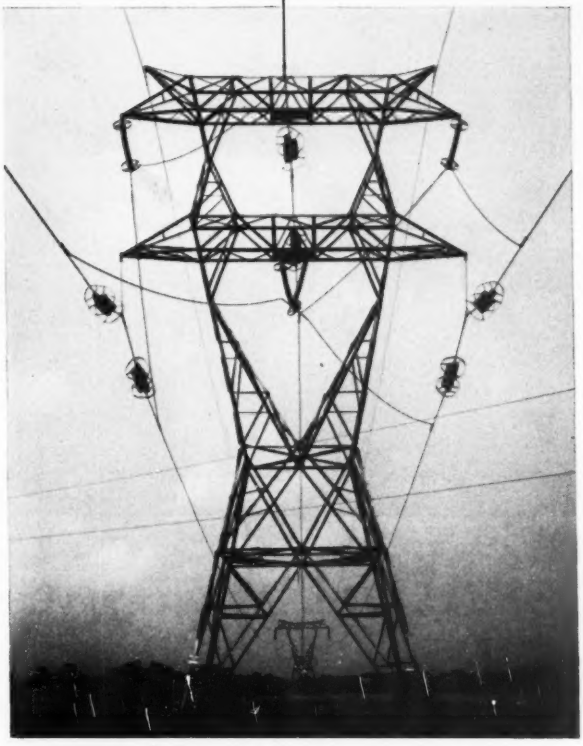
Converting to defense production? You'll need the greater lighting efficiency of Wheeler Fluorescent Fixtures. They're as important a production tool as any machine on the line! Whatever you manufacture . . . whatever the size of your plant . . . whatever your plant conditions, there's a Wheeler Fluorescent Fixture that's right for the job — Wheeler-engineered for efficient operation, ease of installation and maintenance savings. Get complete details from Wheeler Reflector Co., 275 Congress St., Boston 10, Mass.

Wheeler REFLECTORS

Distributed Exclusively Through Electrical Wholesalers

MADE BY SPECIALISTS IN "SKILLED LIGHTING" EQUIPMENT SINCE 1881

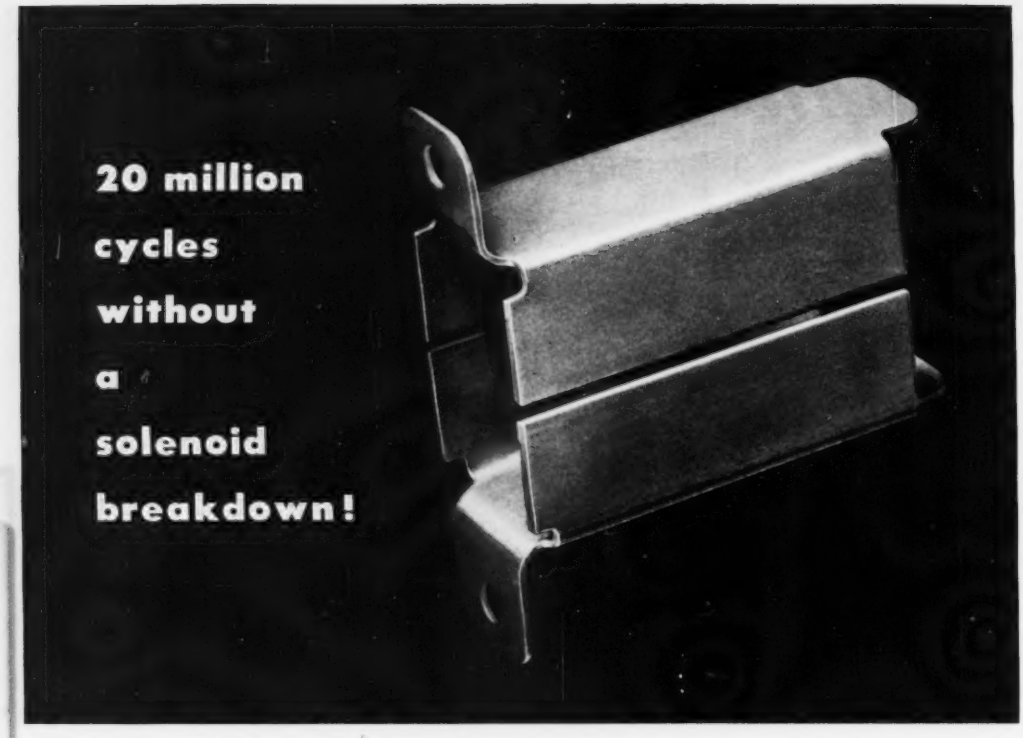
Right Down the Line



With our Tower Department, "Right down the line" means—be *right* every step of the way from specifications, design and fabrication, to hot-dip galvanizing. It may take many years for such thoroughness to prove its value. But the longer it takes the less Blaw-Knox Towers cost you in the end . . . and no more at first!

BLAW-KNOX
TRANSMISSION TOWERS

BLAW-KNOX DIVISION OF BLAW-KNOX COMPANY
2013 FARMERS BANK BUILDING, PITTSBURGH 22, PA.



IT'S MADE OF BERYLCO BERYLLIUM COPPER

For safeguarding lives and property, brakes on a hoist are as essential as brakes on a car. Yale & Towne uses solenoids to actuate the brakes of its high-performance electric hoists. An integral part of the solenoid is the plunger guide shown here, made for Yale & Towne by the Instrument Specialties Co.

The plunger is made of laminated silicon steel and tends to exert a filing action on the guide, which is not lubricated. Under severe conditions, the plunger operates at 400 cycles per hour. Other materials tried in this application wore through, stuck, caused downtime and high maintenance costs. Stainless steel, for example, had a life of 250,000 cycles, phosphor bronze a life of 1 million to 2 million. Berylco was still going strong at 20 million cycles, at which point the test was discontinued. Maintenance costs dropped to a phenomenal 0.2% a year, largely due to the use of beryllium copper . . . and, of course, downtime was practically eliminated.

Resistance to wear is only one of the many outstanding properties of versatile **BERYLCO** beryllium copper. Others —such as high conductivity, elasticity and strength—can be obtained alone or in combination, depending upon the alloy selected. It will pay you to investigate what Berylco can do for you. Take advantage of the technical knowledge of the world's largest producer of beryllium copper. Blueprint your problem, or send for sample material.

BERYLCO IS AVAILABLE as casting alloy in ingot form, rounds, rectangles, hexagons or squares, wire and strip.

VALUABLE ENGINEERING INFORMATION on Berylco beryllium copper is compiled in a series of monthly technical bulletins. To receive your copy regularly, write on your business letterhead.

BERYLCO THE BERYLLIUM CORPORATION

DEPT. 1D, READING 10, PENNSYLVANIA

New York · Springfield, Mass. · Cleveland · Dayton · Detroit · Chicago · Minneapolis · St. Louis · Seattle · San Francisco · Los Angeles

Representatives in principal world-trade centers

From Switchboard Wires to Power Cables... specify U. S. RUBBER

A typical example of "U. S." leadership is Laytex-Neoprene Supervisory Control Cables. In its 19 years of manufacture, not once has a failure of this cable ever been reported. The insulation resistance of these cables actually improves in wet locations!

The small diameter of the Laytex® insulation makes unnecessary the enlargement of cable ducts where signal service is expanding. The Neoprene jacket provides high resistance to abrasion and other abuse, and is highly resistant to oil, flame, and sunlight. The cables are light in weight, easy to install. United States Rubber Company, Electrical Wire and Cable Department, Rockefeller Center, New York 20, N. Y.

PRODUCT OF

U.S.RUBBER

SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

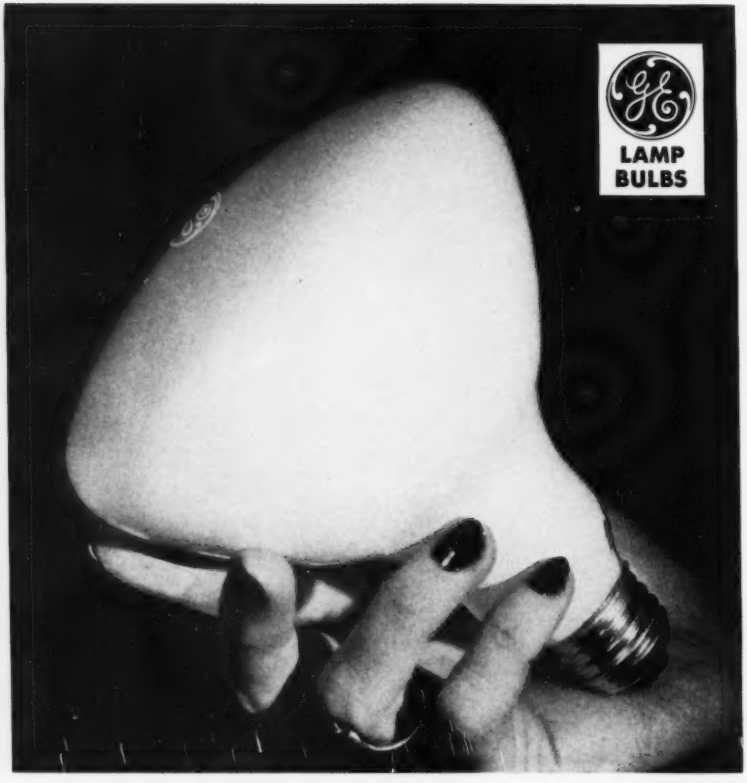
NEW G-E INDIRECT 3-LITE BULB

. . . provides far better light in table lamps

BALANCE OF UPWARD AND DOWNWARD LIGHT

"ALL-OVER BRIGHT" —GIVES SOFTER LIGHT

CHOICE OF THREE BRIGHTNESS LEVELS



GENERAL ELECTRIC'S new indirect 3-lite bulb was designed expressly for use in portable lamps—both new and old. It has a special shape that directs the light both upward and downward. This pleasing balance of up-and-down light gives better over-all room lighting, makes seeing tasks easier.

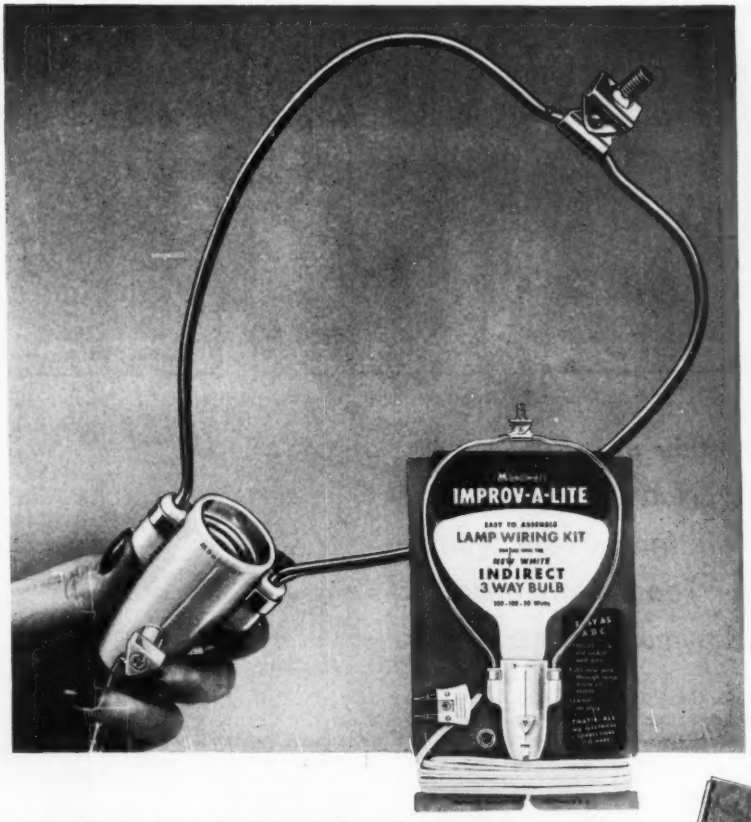
The indirect 3-lite bulb also has a new inside white finish—the "Q" coat—which diffuses the light over the entire surface of the bulb, gives an all-over bright appearance. The light is softer; reflected glare is reduced; reading is easier. Room shadows are soft-edged instead of harsh, an effect which is flattering to home furnishings. And the G-E indirect 3-lite bulb gives three levels of brightness at the flick of the switch—50, 100, or 150 watts.

Now being featured in the newest portable lamps, the indirect 3-lite bulb may also be effectively used in old table lamps by means of adaptor units like the one shown at right.

GENERAL ELECTRIC

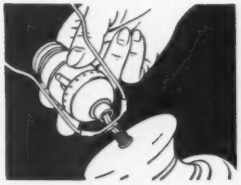
NEW MONOWATT IMPROV-A-LITE

Converts table lamps for 3-way light



EASILY INSTALLED

Quickly wired in three simple steps . . . no electrical connections to make.



Remove old wiring

Pull new wire through lamp; screw on socket

Clamp on plug

IMPROV-A-LITE GIVES YOUR HOME LIGHTING PROGRAM A KEY

use these sales helps

TV — 1 minute spot film ·
Radio scripts · Newspaper mats ·
Envelope stuffers · News releases

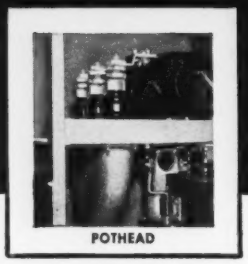
Write for this SALES PROGRAM

MONOWATT

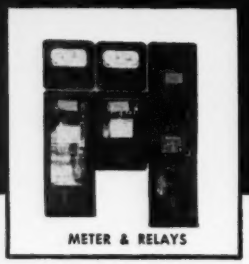
MONOWATT INCORPORATED · A GENERAL ELECTRIC AFFILIATE · PROVIDENCE 7, R. I.

SCS SUBSTATIONS

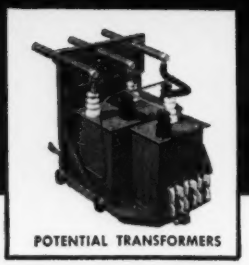
Components Arranged for



POTHEAD

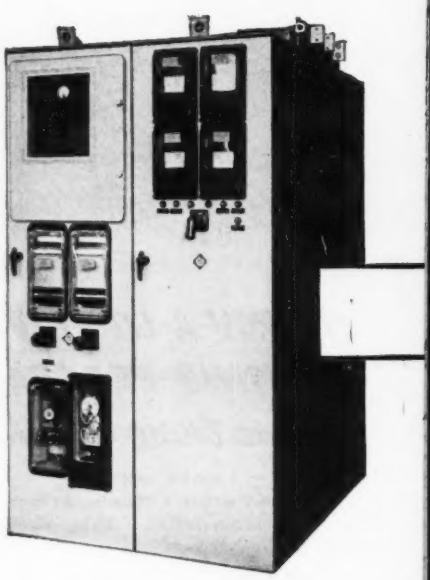


METER & RELAYS



POTENTIAL TRANSFORMERS

Fitted Together in a Single Modern-Appearing Housing—Transformer and Switchgear are Individually Built—Each Designed for Top Performance and Arranged for Maximum Accessibility.



ALLIS-CHALMERS SCS Single Circuit Unit Substations are designed for maximum accessibility . . . to save you time and money in testing, inspection and maintenance routines.

HERE'S HOW IT'S DONE:

1. Transformer and switchgear are divided into two independent sections, both contained in the single substation housing.

2. All switchgear components — including potential transformers, current transformers and control power transformers — are grouped in one section. Potential and control power transformers are drawout mounted for easiest inspection, testing, maintenance, or replacement.

3. Meters, relays and controls are dead-front mounted behind the front door for accessibility and safety.

4. The single rear door is hinged for quick, convenient access to internal power connections . . . testing and inspection are made easy . . . gasket maintenance is reduced.

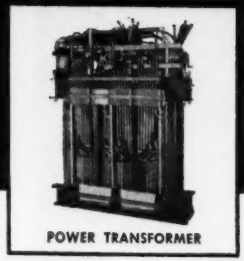
A-3267

Pioneers in Load Ratio Control
Originators of 5/8% Step Regulators

ALLIS-

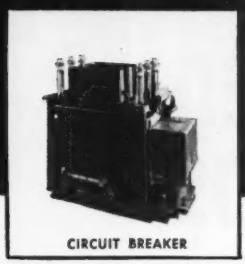
ARE DESIGNED WITH

Low Cost Maintenance!



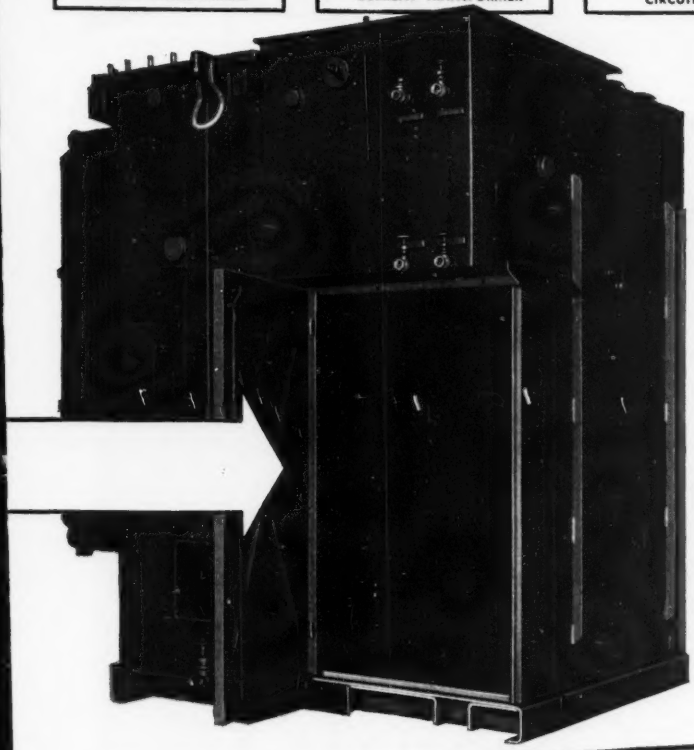
POWER TRANSFORMER

CURRENT TRANSFORMER



CIRCUIT BREAKER

LRC MECHANISM



WHAT CAN THIS ACCESSIBLE DESIGN MEAN TO YOU?

First—Lower Maintenance. Easily accessible components reduce time and effort required for servicing.

Second — Easier Testing and More Thorough Inspection because components are compactly arranged, highly accessible.

Third — Greater Safety. Operators and meter readers have access only to the dead front controls.

To learn more about these modern appearing SCS Unit Substations and how they can be fitted into your distribution system quickly, call your nearby A-C Sales Office or write Allis-Chalmers, Milwaukee 1, Wisconsin for bulletin 11B7457.

CHALMERS

A-C ALLIS-CHALMERS

Preferred for Panel Mountings—

K&M EBONIZED ASBESTOS

K&M Ebonized Asbestos used by Electric Machinery Mfg. Company, Minneapolis, for both the relay and contactor panels of this E-M Rubber Mill Control for two 150 H.P., 720 rpm, 550-volt, 0.8 power factor synchronous motors.

Provides these wanted qualities:

- **HIGH MECHANICAL STRENGTH**
- **EXCEPTIONAL DIELECTRIC STRENGTH**
- **RELATIVELY LIGHT WEIGHT**
- **EASY TO CUT AND DRILL**
- **APPEARANCE THAT HELPS SELL**

Whether for a large control panel, or as a mount for a small component unit, electrical manufacturers and contractors everywhere are finding K&M Ebonized Asbestos the ideal electrical insulating material. Ideal, because it's easy to work . . . has the required physical and electrical characteristics . . . and provides a finished appearance that customers take pride in!

Compounded of asbestos fibers and binding cement, pressure molded to high density, and impregnated with a special insulating compound, K&M Ebonized Asbestos is available in sheets 42" x 96" from ⅛" to 4" thick and in sheets 48" x 96" in thicknesses from ¼" to 2". It may also be ordered cut to specific sizes, with edges beveled if desired.

To learn just how you can benefit by using K&M Ebonized Asbestos for panel mounting, test tables, bus bar runs, switchgear compartment linings, and other applications, write us today.

Nature made Asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

In Canada: ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG, VANCOUVER

CORNELL-DUBILIER CAPACITORS
FOR POWER-FACTOR IMPROVEMENT

40TH ANNIVERSARY CORNELL-DUBILIER CAPACITORS 1910-1951

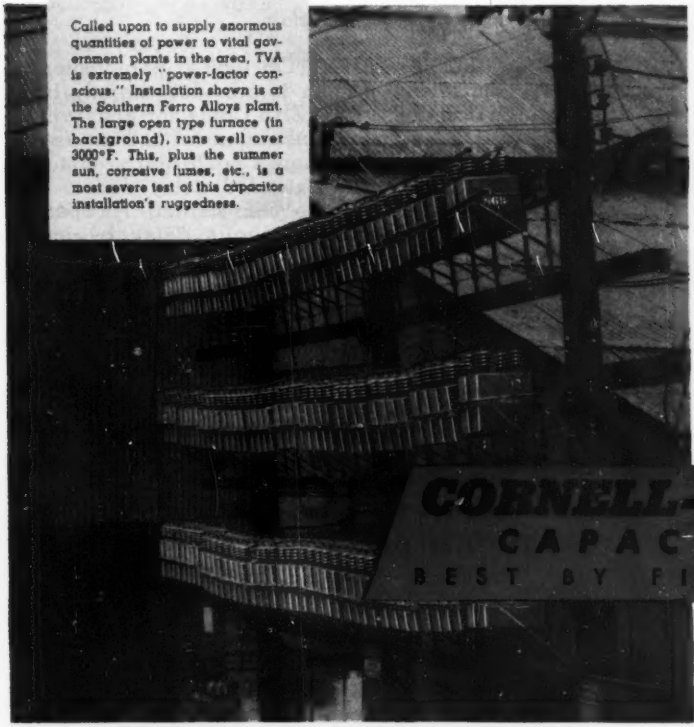
Another Cornell-Dubilier Field Performance Record:

491 MILLION KVAR HRS.

OF TROUBLE-FREE CAPACITOR SERVICE

FOR T.V.A!

This record of 491,961,600 Kvar hours of dependable field service is typical of more than 4,000 C-D power-factor installations made in the past decade. Among the many reasons why Cornell-Dubilier capacitors have given so many years of trouble-free service under the severest operating conditions is Cornell-Dubilier's engineering standard which provides for the lowest dielectric unit stress and highest major insulation level.



Called upon to supply enormous quantities of power to vital government plants in the area, TVA is extremely "power-factor conscious." Installation shown is at the Southern Ferro Alloys plant. The large open type furnace (in background), runs well over 3000°F. This, plus the summer sun, corrosive fumes, etc., is a most severe test of this capacitor installation's ruggedness.

HERE'S WHY C-D CAPACITORS STAND UP IN THE FIELD

- **Wide margin maintained between paper and foil coordinated with major insulation to provide highest impulse level.**
- **Sturdy steel tension equalizing band and rigid end plates insure uniform distribution of stack pressure.**
- **Laminated insulation between case and sections insure high safety-factor for transient voltages.**
- **Lowest dielectric unit stress.**
- **All C-D capacitors from 230 to 13,800 volts in all sizes are given an energization test as a form of quality control, by applying full rated voltage for period of time sufficient to establish ultimate heat rise.**

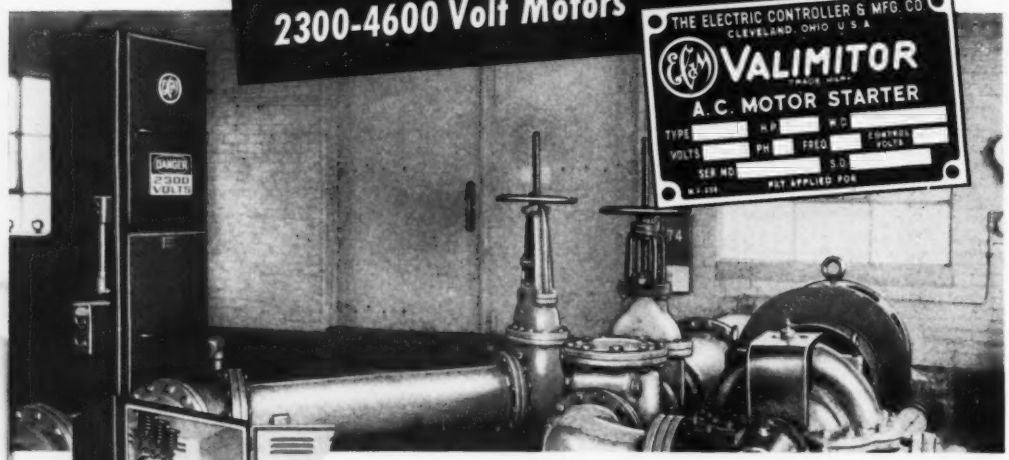
C-D capacitors can also be provided in weatherproof housings, switched or unswitched and completely assembled for energizing at the field site to meet specific sub-station needs. Your inquiries are cordially invited. Our field engineers will be glad to discuss the many dollar and maintenance saving characteristics of Cornell-Dubilier capacitors.

CORNELL-DUBILIER CAPACITORS BEST BY FIELD TEST

Cornell-Dubilier Electric Corp., South Plainfield, New Jersey.

***Other plants:** New Bedford, Worcester and Brookline, Mass., Indianapolis, Ind.; Providence, R. I. and Cleveland, Ohio.*

SAVE MANPOWER—Reduce Down Time with these FUSELESS Starters for 2300-4600 Volt Motors



No waiting for fuse replacement* just pressing a button to restart cuts down production delays

With these EC&M VALIMITOR (volt-ampere-limitor) Starters, complete protection is provided directly by the VALIMITOR coils, Type ZHS Contactor and Type ZM Overload Relays having instantaneous and inverse-time-element trip features. There's *nothing to replace* should a fault occur—no extended delay due to a momentary overload or too frequent starting. An operator can restart the motor *without delay* by just pressing a button.

* *When high voltage fuses operate due to a short circuit fault, on overload or too frequent starts of the motor, an experienced person is needed to restore service and get the motor running again. Length of shutdown is dependent on the time required for this man to reach the scene—a return trip to the storeroom for fuses increases the delay.*

KEEP ESSENTIAL DRIVES moving

Pumps, compressors and conveyors and similar drives are often the "Key" to a plant's production. Free them from unnecessary stoppages by EC&M VALIMITOR Starters. Short circuit protection is unlimited. Thermal capacity throughout the starter is equal to or greater than that of the average motor.

For Complete Facts... Ask for

T9-117 REPRINT Bulletin

THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79TH STREET • CLEVELAND 4, OHIO

The case of the voracious

cooling water

Inlet-end corrosion of a rather vicious character was causing serious trouble in the condenser tubes of a large power company's seaboard plant.

With the utility's engineers, Anaconda set up a three and one-half year test of the corrosive action of the cooling water used at this plant on a variety of tube materials, including Admiralty alloys, aluminum brass and aluminum bronze, and copper-nickel alloys.

At the end of this period, careful observation and analysis of results proved Ambraloy 927 (Anaconda aluminum brass) to be most advantageous in over-all performance and cost for this application.

This story describes a typical service by Anaconda's Technical Department. Through this department, Anaconda has saved money and trouble for many utilities and industrial companies faced with condenser and heat exchanger problems. May we help you? The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass, Ltd., New Toronto, Ontario.

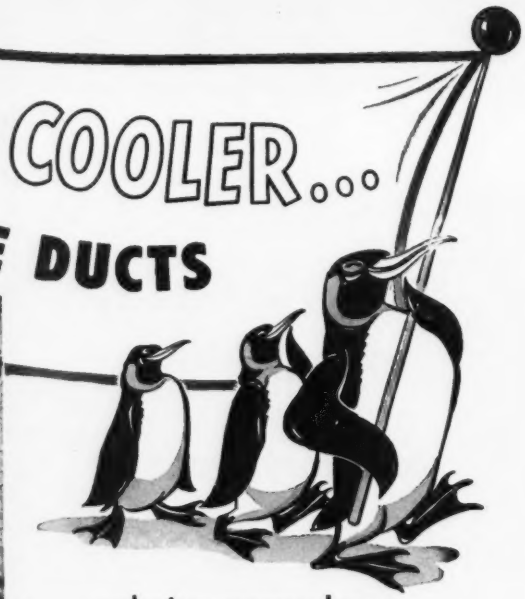
for efficient heat transfer

ANACONDA®

HEAT EXCHANGER TUBES

50124

Cables run COOLER...
in TRANSITE DUCTS



. . . reducing copper losses
. . . increasing current capacity
. . . prolonging insulation life

YOU REDUCE copper losses . . . increase current carrying capacity . . . and prolong insulation life, when you run your cables in Transite* Ducts.

Current carrying capacities can be increased in a typical duct bank as much as 5%, or I^2R losses can be reduced 11%, for cables located in Transite as compared with other ducts used for power circuits.

And, Transite Ducts assure permanent duct banks because Transite is incombustible; is immune to rust and rot; is unaffected by electrolysis; will not slag under action of an arc, and will retain its high original strength.

An unusually smooth bore assures no injury to cable sheath, either in natural movement under load, or when pulling-in cables. Long, lightweight lengths can be quickly and economically installed. In addition, a full line of fittings simplifies even the most complicated of installations.

For full information on Transite Ducts, write for Data Book DS-410. Johns-Manville, Box 290, New York 16, N. Y.

JM

*Reg. U. S. Pat. Off.

How Transite Ducts increase current carrying capacities

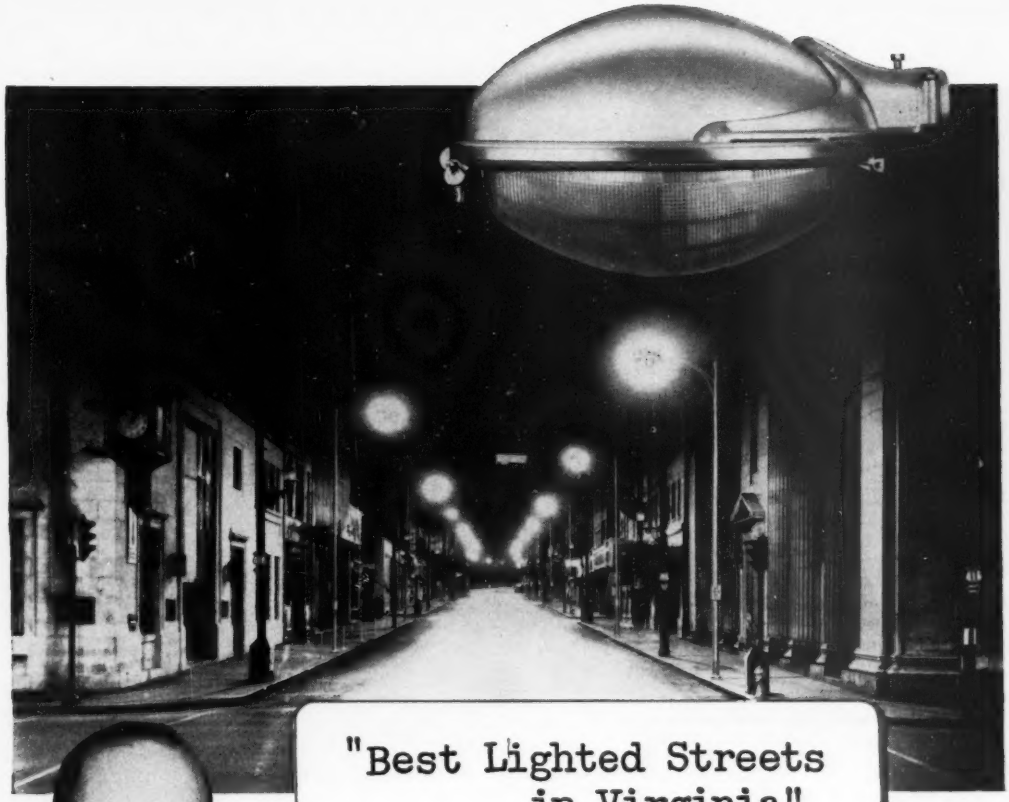
Type cable 3 cdr. 500 MCM Compack Sector, 15 KV
(6th Edition AEIC Spec.)
No. of cables—3 (all loaded in one bank)
Daily Load Factor—75%
Earth Temp. ambient—20 C

	Transite	Other
Total Therm. Res. to Dielectric Loss (C watts/ft.)	5.66	6.17
Total Therm. Res. to Copper Loss (C watts/ft.)	4.44	4.95
Temp. Rise from Dielectric loss (C)	1.9	2.1
Allowable Rise for Copper loss (C)	59.1	58.9
Allowable Watts per ft. cable	4.44	3.96
Allowable Current—(Amps. per cdr.)	386.	365.
Allowable Current—(Relative %)	105.6	1.00.

Johns-Manville *Transite Ducts*

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement



"Best Lighted Streets in Virginia"

City Manager, Arthur Owen, Roanoke, Virginia, points with pride "to the first large-scale application of truly modern lighting in the Southeastern United States". The Westinghouse OV-20 mercury vapor lighting system, installed by the Appalachian Electric Power Company, is making a hit with the citizens:

"We have already ordered a sizable extension to relight our secondary business streets, and we believe that universally favorable response to this lighting system will eventually lead to installation of hundreds of similar units on our arterial approaches, bridges and viaducts."

Arthur B Owen

What's more, they have invested in a system that is easy to maintain. Hinged construction of the OV-20 makes routine cleaning a matter of minutes. Relamping can be done with one hand.

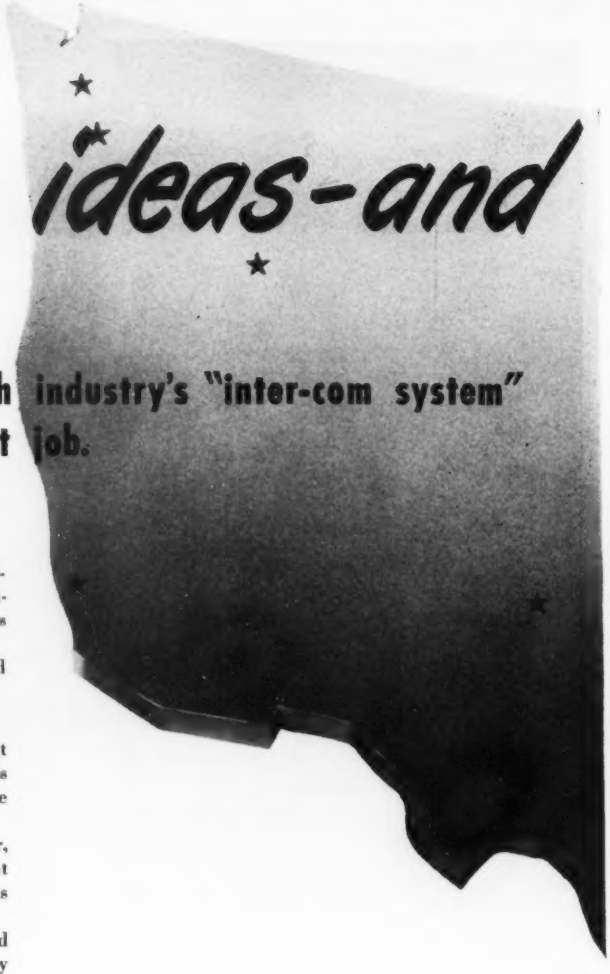
Whether you buy lighting, install lighting or plan lighting, it will be worth your while to investigate the Westinghouse mercury vapor lighting story. Send for B-3876A, Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

J-04302

YOU CAN BE SURE.. IF IT'S
Westinghouse

PLANNED
LIGHTING SYSTEMS

"It takes ideas—and



Here is the great-growth industry's "inter-com system" doing its most important job.

THE AMERICAN BUSINESS PRESS is industry's inter-communications system. The great-growth electric power industry's "inter-com" is Electrical World.

But a mere mechanical system alone can't hold *this* job. It demands ideas and leadership.

For example:

After Electrical World editors saw the urgent need to clarify the electric power industry's safety methods, they worked a solid year on the project.

We planned the Safety Issue for September, 1949. But we found that doing the job right demanded another year's work, and the issue was published on October 9, 1950.

The editors traveled from coast to coast and enlisted research and editorial help from safety experts in 31 utility companies (spotted in red on the map).

RESULT:

Electrical World readers saw the industry's accident-prevention problem from a new perspective in an issue organized and tabulated for swift action. 91 separate job routines were listed, with the risks involved and remedies for every risk. It was a wholly new concept of accident prevention.

As this is written, electric power industry men have bought nearly 20,000 reprints, with no promotion or urging from us. And we can show you a file full of quotes from leaders of industry, praising this service in the interests of safe operation.

Here is Electrical World stimulating the most advanced thinking on safety, a major industry problem—then putting all ideas and information into the clearest, most useful form and making it available to all. That's the industry's "inter-com system" at work on its most important job.

This is the creative editorial service that stimulates an alert, responsive audience of readers—*whose interest focuses itself on your advertising*, when you make your advertising useful to the man on the job.

For action in the great-growth industry, throughout America,

leadership!"

GOOD ADVERTISING PAYS IN Electrical World

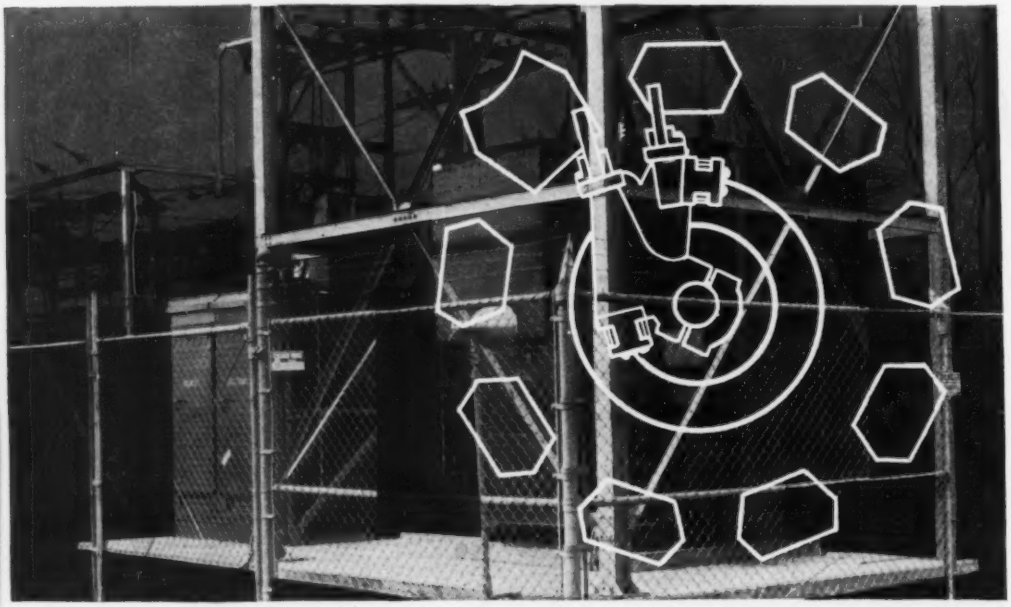
JOURNAL OF THE GREAT GROWTH INDUSTRY FOR 77 YEARS

A McGRAW-HILL MAGAZINE
McGRAW-HILL BUILDING, NEW YORK 18

ABC • ABP

ELIMINATE ALL ARCING

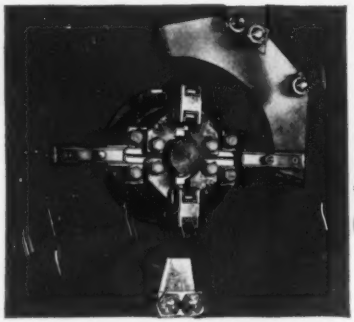
ON TAP SELECTOR SWITCH CONTACTS WITH . . .



. . . MOLONEY LOAD TAP CHANGERS PROVIDED ON FEEDER VOLTAGE REGULATORS, REGULATING TRANSFORMERS, LOAD RATIO CONTROL TRANSFORMERS

All Moloney Feeder Voltage Regulators, Regulating Transformers and Load Ratio Control Transformers are provided with Load Tap Changers which feature a load transfer switch to relieve the tap selector switch of all arcing duties. The load transfer switch has only four stationary contact tips per phase as compared with eighteen on the tap selector switch. This arrangement not only reduces the number of contacts subject to arc erosion, but also permits longer arc clearances to assure positive break of the arc. Liberal clearances of current carrying parts result in maximum capacity of the regulating equipment with minimum physical size. The load transfer switch, which is the only switch required to transfer load current, is provided with accelerating springs and is driven by Geneva gears. This assures quick break of the arc.

This is but one of the many features of the Moloney Load Tap Changer. This same sound basic construction is found in the regulating apparatus on which the tap changer is used.



Liberal clearances prevent establishment of an arc between adjacent current carrying contacts of the load transfer switch. Special alloy arcing tips prevent damage to the switch contacts as they are opened or closed.

ME51-10

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

Editorials

Utilities' Part in Civil Defense

Utilities have to render dependable service. Even when facilities are disrupted by storm, companies are expected to restore them quickly. This also will be expected of them if A-bombs are dropped and large areas devastated. Like every other segment of the productive system of America suppliers of electric service must set up adequate safeguards against internal disruption as well as external ruin.

To prepare effectively will mean planning and organization of manpower and of facilities. Measures that have been set up to handle emergencies arising from storm, flood, fire, etc, can be the framework of what is required for the present emergency. They need only to be expanded to deal with intensified destruction on the one hand and with intensified subversive activities on the other. All along the line there must be functional coordination with Civil Defense forces.

Utilities are good citizens. They will therefore be expected to do their share in setting up Civil Defense staffs and programs. For certain key positions the utilities have better qualified persons than any other agency would be likely to have. These ought to be available to contribute their good advice during the formative stages and subsequently on matters of liaison and organization.

Zealous volunteers from non-utility sources may propose measures that would hamper utilities in making their own specialized contributions to the best advantage. Such instances showed up in some of the early regulations. It took sane power representatives to point out that the citizens hardly could keep their radios turned on to receive instructions after a bomb hit if they had already pulled their entrance switch to guard against fire from crossed wires and broken gas pipes.

Generally speaking, however, power companies should husband their forces for their own critical services and not let them be spread thin over large areas. The employees will be eager to show their patriotic zeal by joining up with the air wardens and other defense and disaster groups. Some of those very public-spirited citizens are likely to be the employees most important to the power companies for place in the companies' emergency set ups. To avoid embarrassing changes it seems desirable that power company plans by now should be advanced to the point where all individuals should know what their company assignments would be in an emergency. Those who are not needed or at least not needed through all stages of an emergency might then feel free to sign up for civic duties.

Nor should the Civil Defense groups expect to be in position to commandeer the automotive equipment or the communication systems of the power companies. Both will be in intensive use to meet the greatly expanded demands upon them after the bombs have struck. The point is to coordinate their use without relinquishing them to the supervision and direction of Civil Defense authorities.

Corrosion Prevention

Do turbines corrode when standing idle? Do overhead ground wires have anything to do with tower leg corrosion? Is marine growth likely to affect a pipe in a 4-ft trench under salt water? Has electrolysis damage to cables increased or decreased since the disappearance of trolley cars? What good are magnesium anodes for underground cathodic protection?

There was a time when questions like these were answered largely by opinionation or the best consensus that could be elicited from the meeting of minds at a local electrolysis committee session. There was much confusion until the trial-and-error techniques of those groups evolved bonding and drainage methods that saved the lead cables and pipes from marauding fugitive currents from the trolley rails and return feeders.

Meanwhile the gas and oil pipe lines were multiplying both in mileage and in need for protection against galvanic deterioration. Until about 1940 there were only some 600 engineer-electrochemists in the national organization devoted to industry-wide discussion of the problems. In 1944 the numbers began to expand until now the National Association of Corrosion Engineers has 2,800 members including 300 of corporate status. That it is a virile forum is indicated by the registration of 1,300 at the recent convention in New York with 77 exhibits covering over 22,000 sq ft.

Some 35 or 40 members are from combination gas-electric utilities and a few are from electric utilities. That is no index of the benefit that might be derived in acquiring answers to the above typical questions. In fact the power companies could well seek a recognized group status in the association. For the association is no longer a monopoly of the pipe-lines.

What Is a Farm?

Up to 1950 the official Census Bureau definition of a farm was a place with an annual agriculture production of $250 or more. This included produce grown for home use.

For the 1950 farm census the definition was different. Quoting an official release:

"In 1950 places of 3 or more acres were counted as farms only if agricultural products, exclusive of home garden, with a value of $150 or more were produced in 1949. Also in 1950, places of less than 3 acres were counted as farms only if the value of products sold amounted to $150 or more."

Figures for all states have not yet been released, but the 1950 census will probably show about 5.5 million farms in contrast to the 5.9 million reported in 1945. The new definition cannot be held accountable for the whole decrease. The historic trend is toward fewer and larger farms, and there are many other factors in the picture.

The reduction is less than 7%. But a small change in a total figure can be the result of very large changes in some of the component figures. In Connecticut, for instance, the reduction is from 22,241 farms in the 1945 census to 15,608 in the 1950, and in Massachusetts from 37,007 to 22,174.

Farm service in the East is preponderantly by power companies. In most other sections the cooperatives and power companies serve approximately an equal number of consumers, or the co-ops serve a few more. In 1949 of 5 million farms served about 2.4 million were on power company lines, 2.6 million on co-op lines. This numerical supremacy of the co-ops is likely to increase. How much cannot be determined until final 1950 census figures are available.

Evaluate Customer Peeve

Whether to budget money for supplementary facilities or alternatively for reinforcement somewhere, backup protection, automatic controls, etc, is a problem of balances. How much will it cost, how much will be gained on the other hand in operating economy, reliability of service and/or prevention of apparatus damage or personal injuries are items not too hard to estimate.

Almost invariably, however, the equation has to have for completeness a term representing an intangible factor. It is the term representing responsibility to the public, obligation to customers, disaffection arising from outages or low-grade service. How much are they worth? What is the value of customer good-will? What numerical entry should the equation have in order to balance?

Hardly anyone is unaware of the term, but very few know what to set down for the quantity. As a consequence management usually closes its eyes and goes into a mild trance to conjure up an answer that will balance the equation and sanction the expenditure.

Engineers who make the proposal estimates are almost completely in the dark about the yardsticks management uses in evaluating public good will or ill will. There is no good reason why they should be kept in the dark. Someone in the organization usually knows how much an industrial customer loses when he is deprived of his electric supply or a farmer loses when his service is interrupted. Why not pass on the information? In fact it might be well to move toward generally acceptable values for an hour of outage for each class of customer and for a given percentage of voltage degradation.

With such factors established it would not be so sketchy a process of bolstering the reliability of, say, distribution at minimum outlay and most informed allocation of the reinforcements. It seems the only way to know whether to devote the expenditures to the substations, the primaries, the network, the transformers, the secondaries, or the services. Distribution would profit by such an analysis.

Customer relations will also profit materially. The application of the customer's point of view to the science of system planning is entirely practicable, and the combination of the two functions engineering and customer relations can eliminate the customer peeve.

The Electrical Week

INDUSTRY MOBILIZATION—New defense power demands coupled with delays in field construction and equipment production have narrowed gap between capacity and load, Depa survey finds (p 80) . . . James F. Fairman and Ken G. Whitaker are sworn in as Depa deputies (p 80) . . . NPA and Depa set rules to help utilities get aluminum and copper (p 81) . . . Industry M Orders start on p 81 . . . Depa recommends that DPA approve 22 applications for rapid tax write-offs on electric generating capacity expansion (p 81) . . . NPA will revise Regulation 4 to save its "write your own DO" system for MRO supplies (p 82) . . . REA wins fight to allot materials to borrowers (p 82, p 90).

WASHINGTON—Pacific Gas & Electric Co and Bureau of Reclamation sign 10-year contract whereby Reclamation customers will receive service over company lines (p 85) . . . Richard D. Searles is nominated as Undersecretary of Interior (p 85) . . . Interior Secretary Chapman takes Roanoke Rapids case to U. S. Circuit Court of Appeals (p 85).

ELSEWHERE—Utility securities are a good investment, Walter H. Sammis, president of Ohio Edison Co, tells convention of the National Federation of Financial Analyst Societies (p 83) . . . SEE Convention is told power restoration will be essential should atomic disaster strike (p 86) . . . Power systems should be designed with one eye on the effects of atomic explosions, Texas A&M Conference of Protective Relay Engineers hears (p 87) . . . Temporary injunction granted against sale of Washington Water Power Co to three Washington PUD's is made permanent (p 88).

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Some 940,000 tons of secondary copper in unalloyed and alloyed forms was recovered from copper-base scrap in 1950. That was 33% more than in 1949 but 2% less than in 1948.

The largest prepayment — advance payment on principal—by any co-op in the history of the REA has been made by the Colquitt County Rural Electric Company, Moultrie, Ga. Its $275,000 prepayment topped the former record of $262,000 held by the Lower Colorado River Electric Cooperative, Inc, Giddings, Texas.

Not all the difficulty in staffing Depa, NPA's Power Equipment Division, and other mobilization agencies is in finding qualified technical and administrative personnel. Some agencies are finding it even harder to get office space and secretaries.

The International Brotherhood of Electrical Workers, AFL, and the Utility Workers Union of America, CIO, have rejected second-place prizes awarded their union publications by Freedom Foundation "for outstanding defense and extension of the American way of life." William J. Pachler, UWUA secretary-treasurer, said the union could not accept the award because Freedom Foundation is sponsored by interests opposed to "labor's objectives."

G. A. Grauer, Simplex Wire & Cable Co, Cambridge, Mass., has estimated that $7 million worth of wire was destroyed in the 21 naval vessels lost or damaged at Pearl Harbor. This is an indication of the importance of wire in our mobilization program.

Julius Emspak, secretary-treasurer of the United Electrical Workers, independent, is free on bail pending appeal of his conviction for contempt of Congress. Emspak was fined $500 and sentenced to six months in jail for refusing to answer questions on Communist sympathies put to him by the House Un-American Activities Committee. Other UE leaders face trial on similar charges.

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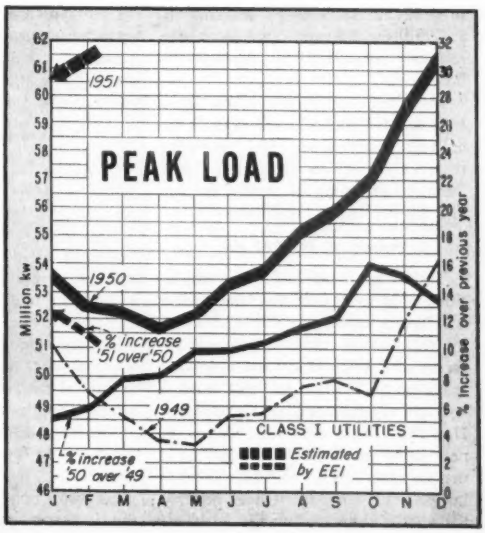

Low Power Reserves Until Late '54 Forecast in Survey Made by Depa

New defense power demands coupled with serious delays in field construction and equipment production are narrowing the gap between power capacity and load. This is the gloomy picture painted by a Defense Electric Power Administration survey prepared in January and published last week in Washington as a part of Congressional testimony by Depa officials.

Prepared to support requests for steel for electric utility use in May and June, the report points out that new load for 1951-52 is about 1.7 times the additional load which the utilities' programs had been designed to meet.

"A reasonably safe power situation cannot now be expected before the end of 1954 at the earliest," the report declared.

Equipment Production Lags

Factory production of heavy power equipment has been "irretrievably set back one or two months" because of materials shortages, Depa said. "Simultaneously," the report continued, "there has been serious delay in the progress of field construction of generating stations which also contributes to this set-back to the power program, in some cases affecting installations which would not have been seriously disturbed by factory delays."

In its statistical computations, Depa subtracted "minimum reserves," including maintenance and operating reserves, as well as "estimated loads" from power supplies under median and adverse hydro conditions.

Margin of 192,000 Kw

Thus under median hydro conditions it is estimated that the nation will have a capacity of 72,353,000 kw by the end of 1951. Minimum reserves of 5,480,000 kw and estimated loads of 66,143,000 kw will leave a "margin as scheduled" of 730,000 kw. However, Depa estimates "delays in new plant" at 538,000 kw, leaving a margin after delays of only 192,000 kw or 0.3% of load. Under adverse hydro conditions the "margin as scheduled" would show a deficit of 528,000 kw while the margin after delays would drop to a deficit of 1,066,000 kw or 1.6% of load. However, it must be remembered that a reserve of 5,480,000 kw must be added to give a true picture of what the industry normally calls reserve.

WILLIAM W. BROWN, Detroit Edison Co, who is the director of the Material and Equipment Division of Depa

Margin as scheduled under median hydro conditions would be 2,067,000 kw by mid-1952, and 3,029,000 kw by the end of 1952. Increasing delays, however, would reduce these margins to 999,000 kw in mid-1952 and to only 13,000 kw by the end of next year, the tabulations indicate. Mid-1953 margin after delays is put at 7%, declining to 5% by the end of 1953.

Defense Loads May Arise

Most of the seven Depa regions (Federal Power Commission's Region VI is divided between Regions IV and V) show a similar pattern. Margins will tend to fall to a low next year, rising during 1953.

Warning that new power-eating defense loads may arise, Depa said that only two regions show any substantial margins for next year, Region V (South Central) and Region VIII (Pacific Southwest).

"In Region VIII," the report said, "the margin shown is undependable since it nearly disappears under adverse water conditions. In Region V, the indicated margin is substantial, and here it is important that the margin be preserved since in no other part of the country is the probability of large new defense loads so high." This region, it is explained, will likely see further expansion of plants making ammonia, explosives, heavy chemicals, aviation gasoline and other petroleum products, synthetic rubber, aluminum, and magnesium.

"In all other regions of the country 1952 margins are nonexistent, and in some regions 1953 margins are nonexistent or inadequate," Depa reported. "This means dangerous infringement on operating reserves, inadequate maintenance, impaired power service, and substantial power-supply curtailment in some regions. It also means that there will be handicaps in selecting suitable locations for new defense production requiring heavy power use."

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Fairman and Whitaker Sworn In as Depa Aides

James F. Fairman, vice president of Consolidated Edison Co, and Ken G. Whitaker, administrative assistant to the Electric Power Board of Chattanooga, Tenn., were sworn in as deputy administrators of the Defense Electric Power Administration April 2.

They were sworn in by Whitaker's brother, Judge Samuel E. Whitaker of the U. S. Court of Claims, in the office of Secretary of the Interior Oscar L. Chapman. Nearly a hundred persons, including Depa Administrator C. B. McManus and other Depa officials, attended the ceremony in the Capital.

Appointment of Fairman, who has been with Depa more than a month, was announced March 29, two days after Whitaker's selection was made known to the public by the Interior Department.

Fairman, a graduate and former professor of electrical engineering at the University of Michigan, joined Consolidated Edison in 1936 after its merger with Brooklyn Edison Co, with which he has served as an engineer since 1925. He has been president of the American Institute of Electrical Engineers and the New York State Society of Professional Engineers and vice president of the National Society of Professional Engineers.

NPA and Depa Set Rules to Assist Utilities Get Aluminum and Copper

Procedures for helping electric utilities to get their requirements of aluminum and copper in the second quarter and steel in May and June were well advanced last week in Washington.

The National Production Authority issued its electric utility order, M-50, covering initially only aluminum conductors. NPA said the order would be expanded to include copper. Defense Electric Power Administration, meanwhile, has issued Defense Order (DO) authorizations for major plant construction requirements for aluminum and copper and is working on steel DO's for May and June delivery.

Metals For Utilities Allocated

NPA authorized for use by the electric power industry 49 million lb of aluminum in the second quarter, compared with an estimated 60 million lb reportedly sought by Depa. Also earmarked for distribution by Depa to electric utilities in the second quarter are 92.7 million lb of copper and 90,000 tons of steel for each of the months of May and June.

Three types of utility use of the "progam materials"—aluminum conductor and accessories, with copper and steel to be added soon—are covered in the new order.

Plant Additions Reported

Major plant additions, defined in earlier Depa orders as projects with a total materials cost of $50,000 or more and including line construction of 15-kv or over, are already being reported to Depa on form DPA-2. Depa has issued most of the second quarter DO's for aluminum and copper for major plant additions in the second quarter, and DO's for steel for May and June are now being authorized. Materials for major plant additions may not be ordered without Depa approval, and materials on hand may not be used without Depa approval after May 1. Splitting projects, to take them out from the major plant addition category, or combining projects, to list them as major plant additions, is prohibited, Depa emphasized.

"Minor requirements" of electric utilities include both maintenance, repair, and operating supplies (MRO) and minor plant additions, those not qualifying as major plant additions. For minor requirements, electric utilities may use DO-48 (minor) for orders of aluminum conductor up to a limit computed in either of two ways. "Standard quota" for aluminum conductor is 20% of the amount of aluminum conductor used by the utility during the calendar year 1950, or the fiscal year ending nearest Dec. 31, 1950.

"Alternative quota," which a utility may elect to use instead of the "standard quota," is defined for aluminum conductor as 80% of the utility's use of aluminum conductor for the corresponding (second) quarter of 1950.

Before using the DO-48 (minor) for aluminum orders, utilities must file a new form, Depa 4-A, with Depa. On this form, the utility reports on how much aluminum it used during each quarter of 1950 and takes its choice between the "standard" and "alternative" quota. Once a utility has elected to use one method, it may not change to the other without Depa's permission.

BERLON C. COOPER, lighting consultant to "Electrical World" and eastern editor of "Electrical Construction and Maintenance," has been named a consultant to the Building Materials Division of NPA. It is expected that most of his work will be with the Electrical Products Section of this division

Under M-50, MRO is redefined for utility use from the definitions in the broader NPA Reg 4. Maintenance and repair include any replacement equipment "regardless of its accounting classification," except that improved or higher capacity material may not be used to replace material "in sound working condition." Operating supplies, for electric utilities, do not include fuel.

Use of the DO-48 (minor) is authorized only for "program material," so far, only aluminum conductor and accessories. Other MRO requirements of utilities may be ordered, with specified limitations under NPA Reg 4, with DO-97. Both NPA and Depa emphasized that NPA orders covering other materials, including other forms and shapes of aluminum, continue to apply to electric utilities.

Aluminum conductor accessories are included in the new order, although they were omitted in the exemption granted electric utilities from the original NPA aluminum order, M-7. Only limitation on aluminum conductor accessories is that a utility may not order more accessories than are needed for the conductor which the utility is authorized to use. No forms need be filed to order accessories.

The order also provides for emergency use of DO's by utilities "for maintenance or repair of its equipment or property, other than buildings, which is damaged or destroyed by extraordinary cause, such as explosion, fire, sabotage, act of the public enemy, flood, storm, or similar catastrophe." In such cases, the utility may use the DO's to order needed materials but must immediately report the use to Depa.

Depa is empowered by the order to receive and make adjustments in hardship cases. Utilities applying for increased MRO quotas must show existing quotas, prior adjustments, increase requested, necessity for increase, output in kwhr per quarter in 1950, and any other pertinent data.

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Industry M Orders

National Production Authority has issued the following M Orders of interest to the electrical industry. Orders not of interest have been omitted.

(*Continued on page* 82)

Copies of orders may be secured from National Production Authority, Washington 25, D. C., or any regional Department of Commerce office.

M-50 spells out a program by which utilities can obtain **aluminum** supplies for distribution and transmission lines.

M-52 limits amount of **molybdenum** in stainless steel to 2.5%.

M-54 tightens controls over deliveries and inventories of **platinum.**

Directions to Previous Orders

Dir 2 to M-12 allows consumers of **copper** and **copper base alloys** who were shut down 15 days or more during the 1950 base period to make special base period adjustments in the second quarter.

Amendments to Previous Orders

Amendment to M-7 postpones for one month (to May 1) restrictions against use of **aluminum** in about 200 civilian products.

Amendment to M-8 changes some of the regulations for inventories and end-use certification of **tin.**

Amendment to M-14 extends **nickel** controls already in effect into the second quarter and lists additional products in which use of **nickel** is banned.

Amendment to M-33 establishes a broad allocation system of **molybdenum** to replace individual directives, effective after May 1.

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Tax-Write-Off Certificates Asked on Utility Expansion

Defense Electric Power Administration has recommended that the Defense Production Administration approve 22 applications for certificates of necessity for rapid tax write-offs on electric generating capacity expansion. Total amount of the recommendations was $191,905,000.

As of March 27, a total of 34 applications for certificates had been referred to Depa, with a total request of $267,330,000.

Details of the applications and Depa's recommendations have not been disclosed. Applications are filed with DPA which refers them to Depa. Depa then makes recommendations to DPA which issues the certificates. No certificates have been issued for electric generating capacity expansion thus far.

F. X. GILG, Babcock & Wilcox Co, who is serving as chief of the Boiler Section of NPA's Power Equipment Division

NPA Will Revise Reg 4 to Save MRO-DO Plan

A rising torrent of orders is killing NPA's plan to have every kind of business issue its own Defense Orders for maintenance, repairs, and operating supplies.

In the hope of saving at least parts of the plan, NPA is revising its Regulation 4, which established the "write your own DO" system for MRO supplies. The revision will knock whole groups of products out of the MRO plan. Scheduled to go are all kinds of chemicals except those used as catalysts, all paper products, containers no matter what they are made of, and wood and other forest products.

The revision will also have a much more specific definition of what "operating supplies" are as contrasted to "production supplies."

NPA was unprepared for the number of orders business let loose for MRO supplies, each bearing the DO-97 symbol allowed by Reg 4. Suppliers of products essential to defense industries have reported that their stocks are being swept clean by orders from non-defense business.

The impact has been particularly heavy on steel products. NPA is making a belated effort to try to police Reg 4 by asking steel producers to report excessively large orders bearing the DO-97 label.

NPA officials are willing to admit the wording of the regulation is at fault. They also think many businesses have stretched the intent of the order in an effort to build inventories.

REA Wins Fight to Allot Materials to Borrowers

(*See Washington Comment,* Page 90)

Rural Electrification Administration has won its fight to distribute scarce materials among its borrowers, at least for the second quarter.

REA's victory came in a letter March 27 from Interior Secretary Oscar L. Chapman to Agriculture Secretary Charles F. Brannan. "Pending development of a permanent plan to provide for the requirements of electrification borrowers from the Rural Electrification Administration for aluminum and copper conductor, I have directed that all electrification borrowers from the REA be treated collectively during the second quarter of 1951," Chapman wrote. "This procedure is wholly an interim measure," he added.

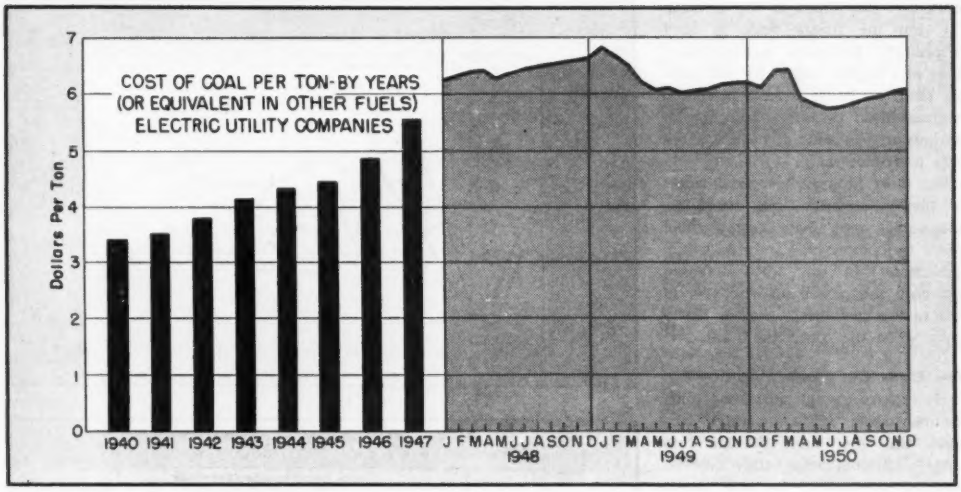
Wickard Will Distribute DO's

Under Chapman's letter, Interior's Defense Electric Power Administration will let REA Administrator Claude R. Wickard distribute Defense Orders for a share of the aluminum and copper conductor and steel allocated to electric power by the National Production Authority, instead of handling REA borrowers' requirements along with those of the other utilities.

Policy For 3rd Quarter Undecided

Emphasizing the interim nature of the concession to REA, Chapman's letter said that he was directing Depa Administrator C. B. McManus to "open discussions immediately" with Wickard "on the question of a permanent policy for the handling of materials allotments, beginning with the third quarter." Chapman said that REA borrowers would be asked to submit reports on their third quarter construction program to Depa although they might do it through REA.

REA immediately asked its borrowers to submit information on their copper and aluminum needs for the second quarter by months. They also were advised that they may use DO-48 (minor) for orders for conductor for minor plant additions and maintenance, repair, and operating supplies under terms of NPA's new M-50 order (see p 81 for details of how this order is to be used).


COST OF COAL PER TON-BY YEARS
(OR EQUIVALENT IN OTHER FUELS)
ELECTRIC UTILITY COMPANIES
Dollars Per Ton
0
1
2
3
4
5
6
7
1940 1941 1942 1943 1944 1945 1946 1947
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1948
1949
1950

Utility Securities—A Good Investment

President Sammis, Ohio Edison Co, Interprets Factors Affecting Industry in Mobilization Economy for Financial Analysts Society

The securities of electric utility companies in a war economy with taxation that is not too inequitable should be attractive. This was the message Walter H. Sammis, president of the Ohio Edison Co, delivered at the annual convention of the National Federation of Financial Analysts Societies last month.

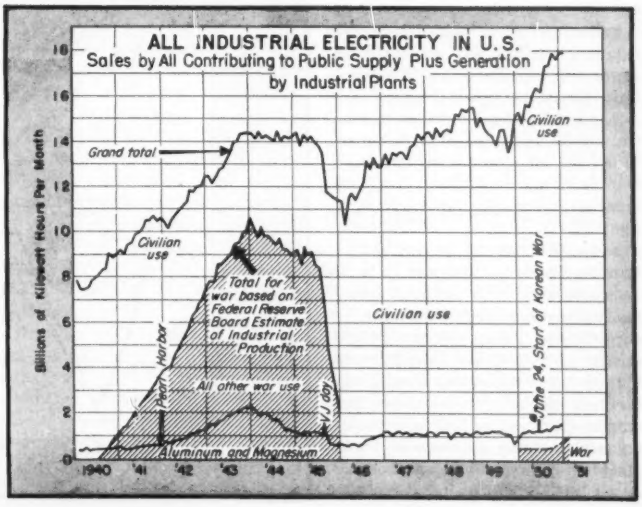
Sammis outlined the great development of the electric utility industry in the past 12 years, interpreted various cost trends, and pointed out the effect of government regulations under the mobilization program.

Here in brief are his comments on various factors which affect the electric utility industry and in turn the market for utility securities:

War Boosts Industrial Sales—During war (and rearmament) years industrial sales rise at an extremely accelerated rate. War production takes most of the industrial power. What electric energy is left may be used for civilian industries (See chart at lower right). The demand of industrial customers rises, but their consumption of electricity rises even faster because of 24-hours-a-day operation.

This means that utilities can supply this power with relatively less cost to themselves. About the only costs for producing and supplying the extra kilowatt hours are fuel and maintenance costs. During wartime normal growth of residential sales is handicapped by restrictions on home building and scarcity of appliances. This is partially offset by increased usage of lighting and appliances as families double up or rent rooms to others. This is especially true in war production centers where people work on shifts.

Fuel Riders Protect Earnings—Coal price today is less than that of two


ALL INDUSTRIAL ELECTRICITY IN U.S.
Sales by All Contributing to Public Supply Plus Generation by Industrial Plants
Billions of Kilowatt Hours Per Month
Grand total
Civilian use
Civilian use
Total for war based on Federal Reserve Board Estimate of Industrial Production
Civilian use
Pearl Harbor
All other war use
V-J day
June 24, Start of Korean War
Aluminum and Magnesium
War
1940 '41 '42 '43 '44 '45 '46 '47 '48 '49 '50 '51

years ago (See chart at top of page 83), but the future price is hard to predict. Increased transportation costs and higher wages for the miners tend to boost price. Increased mechanization of mines and loss of markets to gas and oil have a tendency to reduce it.

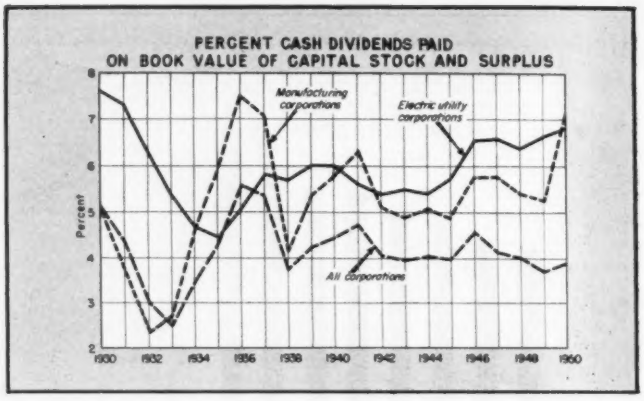
But most utilities have coal riders in their industrial and wholesale rates, and some even extend these riders to commercial and residential consumers. In this way increased coal costs are passed on wholly or in part to the customers. Similar riders apply when the fuel used is oil.

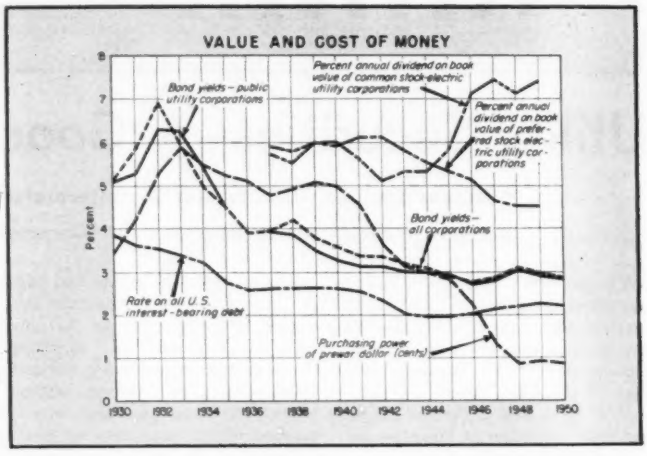
New Units Cut Costs—A utility can rarely replace its old generating units because newer units are more efficient. But when units are added to carry additional load, they can be operated continually as base units. The older units can be idled whenever load drops.

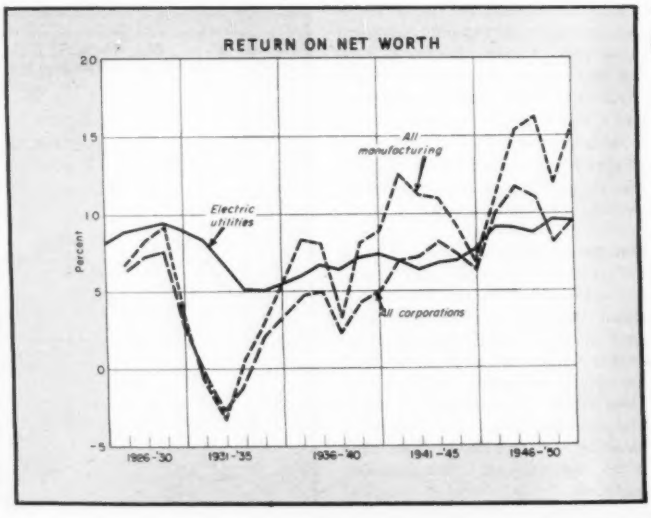
Utility Securities Are Stable—Records show that over a period of years the percent dividends on book value of capital stock and surplus have been more stable than for all corporations and percentage dividend has been higher (See top chart at right).

In an economy where prices of products and wages to individuals have been increasing and the rate paid for money has been decreasing, the percent dividend on electric utility common has been increasing (See middle chart at right). Furthermore, the assets of electric utility companies are in long-lived structures and equipment whose value increases with inflation. Utilities also have a volume of assets in dollars that is several times the annual gross earnings.

The stockholders' return from electric utilties as compared with the return from all corporations and from manufacturing corporations has been relatively stable (See bottom chart at right). From 1926 to 1950 inclusive, a period of 25 years, the average return on electric utilities was 7.5% as compared with 7.8% for manufacturing corporations and 5.5% for all corporations. This shows electric utilities to be favorable both from an average return basis and from a stability standpoint. It also shows that returns from electric utility securities are stable. Utility securities pay when others do not even if they do not pay as much in certain "boom" periods.







TEXAS STYLE, J. E. Cunningham, president of Southwestern Public Service Co, uses power shovel to break ground for Plant "X" near Earth, Texas. The 150,000-kw station, to be completed by June 1953, is company's 11th base load power plant

Reclamation Patrons to Get Power Over Pacific Gas & Electric Lines

Pacific Gas & Electric Co and the Bureau of Reclamation executed a 10-year contract April 3 which calls for bureau customers to receive service over company lines. Reclamation officials in Washington said they are going to advise Congress that several of the bureau's proposed transmission lines in California will not be necessary because of the new contract. Reclamation had asked $5.5 million in new appropriations for Central Valley transmission facilities during the coming fiscal year.

Federal power generated at Shasta and Keswick Dams in the bureau's Central Valley project will be delivered to the company system at Tracy, Calif. Under a rate schedule set forth in the contract, PG&E will serve federal preference customers in the Sacramento and San Joaquin valleys and in Solano, Contra Costa, Alameda, and Santa Clara Counties. The company will continue to purchase output not covered by federal demands under terms of a leter contract executed in December, 1948.

Consumers eligible for preference under law must be located and use power and energy outside the corporate boundaries of municipalities where the company serves at retail. They also must have had monthly demands of 500 kw or more for three consecutive months in the 12 months immediately preceding the date on which the company was requested to commence service. Bureau contractors and the bureau itself will receive power deliveries, but it is to be made only for use outside corporate boundaries of municipalities.

The government will pay PG&E 1 mill per kwhr for delivery at 44-kv or higher, 1 mill per kwhr plus 10¢ per kw of monthly maximum demand for deliveries at less than 44-kv but not less than 22-kv, and 1 mill per kwhr plus 22¢ per kw of monthly maximum demand for all other deliveries.

Reclamation will notify the company annually of its requirements during the next four-year period and, subject to advice by the company, the estimates become a firm obligation after 90 days.

The contract is subject to issuance of an order by the Public Utilities Commission of California authorizing the company to carry out its terms. If the order is not issued within six months, the government may terminate the agreement by written notice to the company.

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Truman Names Searles Interior Undersecretary

Richard D. Searles, an Arizona rancher and president of Salt River Water Users Association and Salt River Power District, last week was nominated for the position of Undersecretary of Interior by President Truman.

Secretary Chapman, who has had no undersecretary since he was promoted from that position in December 1949, said Searles would work in the department's defense activities. A native of Cedar Rapids, Iowa, Searles has been associated with Trans-World Airlines, Arizona Airways, and the Southside Sand & Rock Co.

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Court of Appeals to Get Roanoke Rapids Issue

Secretary of the Interior Oscar L. Chapman has notified the Federal Power Commission he will seek a court review of FPC's decision licensing Virginia Electric & Power Co to develop the controversial Roanoke Rapids site.

March 28 Interior asked FPC to stay its license order pending disposition of the department's suit by the U. S. Circuit Court of Appeals. Under FPC rules, Interior has until May 1 to petition for a court review. Interior will be represented in the suit by the solicitor general.

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Nebraska Power Shorted

Three men were burned slightly and power to two-thirds the state of Nebraska was cut off recently when a bus was short-circuited in an Omaha substation. Nebraska Public Power System officials said exact cause of the short was not known, but "apparently" happened when construction workers installing switches near the bus accidentally let metal pipe brush the conductor. Power was restored within an hour.

SEE CONFERENCE HOST W. J. Clapp, vice president of Florida Power Corp, center of left panel, with speakers H. N. Muller, left, Westinghouse Electric Corp; and E. J. Higgins, American Gas & Electric Service Corp. Right panel, A. J. Skaale, left, Carolina Power & Light Co, quips with J. B. Coltharp, Gulf States Utilities Co; Conference Chairman W. T. Hess, Louisiana Power & Light Co; and J. A. Rawls, Virginia Electric & Power Co. All four presided at conference discussion sessions

Power Restoration Essential Should Disaster Hit, SEE Convention Told

"Should disaster strike there will be no more important job than the restoration of electric service to essential needs and the removal of hazards created by broken lines and damaged equipment." These were the words of J. F. Pennington, Georgia Power Co, who addressed 350 delegates at the conference of the Engineering and Operation Section of the Southeastern Electric Exchange at St. Petersburg March 29 and 30.

To do the job safely and efficiently requires trained, experienced personnel, many with a high degree of skill. The utilities and their thousands of employees who are ready and anxious to do their part should fully recognize this in trying to determine their place in Civil Defense, he said.

A. E. Knowlton, "Electrical World," said the present emergency makes it necessary to maintain a constant state of defense and preparedness. For power companies it is primarily a matter of intensifying and expanding plans and physical facilities generally organized for emergency operation. Utilities must be prepared with adequate capacity, manpower, supplies, and communication; organization for restoration; adequate vehicles, and construction tools; protection against sabotage and espionage; knowledge of the effects of the A-bomb, and well-geared coordination with Civil Defense.

The aim of the Defense Electric Power Administration is to help utilities get materials needed to keep the supply of electricity adequate for industry and essential civilian needs, said Harry I. Miller of DEPA. A power program aimed toward installation of 7 million kw additional capacity in 1951 and distribution of services to increase loads has been developed and materials have been allocated to the end that all machinery should be available on time to meet schedules established by participating companies throughout the country.

Ignorance of basic principles and facts is the cause of belief in socialism, stated Ed Vennard, Middle West Service Co. Workers actually take home 81% of their pay whereas they think the figure is 25%. The key is in management. After a 6-hour session with employees in presenting facts, the area of ignorance is cut in half as proved by "before" and "after" tests.

Square ventilated copper tubes used for low tension buses in sub-

DELEGATES rehash day's events. Left to right across page: C. C. Birchmore, Georgia Power Co; A. R. Waehner, Line Material Co; A. C. Rickborn, Mississippi Power & Light Co; F. W. Smith, Virginia Electric & Power Co; H. M. Towne, General Electric Co; H. W. Page, Florida Power & Light Co; C. G. Mattison, Duke Power Co; and W. K. Harding, also of Duke

stations have high ampere capacity per pound of copper and are very economical to install because the flat surfaces permit bolting of cable clamps for leads to transformers and for take-off cables at the end of the bus, according to W. K. Harding and G. G. Mattison, Duke Power Co.

Use of high-pressure water jets and explosives are satisfactory means for setting poles in swampy and sandy soil when usual methods cannot be practiced, said Judson Gillespie, Gulf Power Co. Each method must be utilized at its most adaptable location. With the water jet method, a 35-ft Class 5 pole can be set to a depth of 5½ ft in 5 minutes using 250 gal of water.

Aerial cable systems are much less vulnerable to damage from hurricane than open wire lines, according to J. A. Lasseter, Florida Power & Light Co. During last fall's hurricane with 122-mph sustained winds and gusts up to 150 mph, there were only two cases of structural failure in over 500,000 conductor ft of aerial cable in service in the Florida system.

A new voltage sensitive control for switching capacitors was described by A. R. Waehner, Line Material Co. As distribution voltage rises or falls, this device is claimed to switch capacitors automatically into or out of the circuit to provide necessary corrections.

More Pressurized Boilers

Pressurized operation of boilers is growing, said S. T. MacKenzie, Babcock & Wilcox Co, because it eliminates infiltration, reduces stack losses, raises inlet air temperature, reduces maintenance (no induced draft fan, less dew point corrosion), and enhances reliability. Decrease in fan power and generally reduced overall cost are further factors which explain the purchase of 54 large pressurized boilers from B&W in 5 years for coal as well as gas and oil fuel, he said.

Demand for poles is at a rate well above 6 million per year and 75% are Southern yellow pine, declared A. T. Ramsay, Southern Bell Telephone Co. He indicated there will have to be production of well over a million in the critical 35 and 40-ft lengths, Classes 4 and 5. Even if the trees are most skillfully cut and reforested, it will take well over 40,000 acres to meet the demand.

TEXAS A&M PROFESSOR N. F. Rode, left, discusses points in his talk with L. P. Works, Wisconsin Public Service Co; L. H. Cardwell, Dallas Power & Light Co; and L. D. Watkins, Southwestern Public Service Co, delegates to conference

A-Bomb Affects Design of Systems, Rode Tells Texas A&M Conference

Power system planning and design with one eye on the effects of atomic explosions were suggested by Prof Norman F. Rode, Texas A&M, at the fourth annual Conference of Protective Relay Engineers. The conference, sponsored at that college, drew 144 engineers from 18 states and took on an aspect of something more than a sectional gathering.

Professor Rode pointed out industries using power would probably also be lost if a major source of power were destroyed in an atomic explosion.

Speaking on carrier current applications, H. J. Sutton, Gulf States Utilities Co, suggested use of double frequency traps on line taps as a way to improve performance of carrier. L. H. Cardwell, Dallas Power & Light Co, told how breakers on a fuse-breaker coordinated system were set for fast opening and delayed reclosing to clear temporary faults. Fuses were set to blow to clear permanent faults.

Development of voltage differential relays was prompted by the rapidly increasing magnitude of short circuit currents and the difficulties encountered in getting current transformers to give true measurements of those fault currents. This was stated by R. E. Phillips, Kansas Gas & Electric Co, whose firm pioneered use of this type of relay.

Timing is the key to prevention of violent movement of overhead conductors when opening and reclosing circuits under short circuit conditions involving heavy currents. So said L. P. Works, Wisconsin Public Service Co. If time delay is desirable on tripping, then reclosing should not be instantaneous where fault currents are high, he added.

Discussing fundamentals of circuit interruption, Dr Erwin Salzer, Allis Chalmers Manufacturing Co, reduced the problem to one of energy dissipation by comparing current to a swinging pendulum. It's easiest to stop a pendulum when it has least momentum, he said; the circuit should be interrupted when the energy to be dissipated is at the zero point of the wave.

R. L. Witzke, Westinghouse Electric Corp, pointed out that transient voltage produced by a fault or by a switching operation can be determined on the network calculator or on the analogue computer. Synchronous switches represent the fault or circuit breaker, and voltages are measured with a cathode ray tube.

YIELDS (%) — Operating Electric Utility Securities

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1951									
Mar. 29	2.87	2.93	3.00	3.96	4.19	4.52	5.47	6.20	7.13
Mar. 22	2.83	2.88	2.95	3.93	4.13	4.49	5.41	6.16	7.04
END OF QTR.									
4th 1950	2.65	2.67	2.78	3.86	4.14	4.51	5.80	6.54	7.44
3rd 1950	2.66	2.67	2.76	3.81	4.08	4.46	5.70	6.54	7.25
2nd 1950	2.68	2.66	2.74	3.79	4.03	4.38	5.38	6.51	7.50
1st 1950	2.59	2.61	2.74	3.78	4.01	4.36	5.22	5.85	6.67

Data: Reis & Chandler, Inc.

WWP Sale Injunction Declared Permanent

The temporary injunction granted against sale of Washington Water Power Co to a group of Washington PUD's has been made permanent by Judge B. B. Horrigan of Pasco, Wash.

At the same time, the judge left the way open for PUD's of Chelan, Stevens, and Pend Orielle Counties to buy Washington Water Power properties within the state from American Power & Light, a New York holding company, or to condemn individually the company properties within the separate counties.

About 25% of the Washington Water Power system is located in Idaho, and Judge Horrigan said he did not believe the 1949 Washington PUD law gave the districts power to acquire properties outside the state. He said his decision might have been different if the PUD's had shown an intention to sell the Idaho portion of the system to interests in that state.

W. L. Thrailkill, assistant general manager for WWP, which opposes the sale, tesified the three PUD's use less than half the power generated by WWP facilities within their boundaries and therefore can get along without the rest of the system. Counsel for the taxpayers group argued 90% of WWP customers are located outside the three counties. PUD counsel had no comment on further plans of his clients in connection with the project.

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Merger Offer Withdrawn

Central Vermont Public Service Corp has withdrawn an offer to acquire the properties and assets of Green Mountain Power Corp, Burlington. In its offer, made last December, Central Vermont proposed to exchange five shares of its own common stock for each share of $6 preferred stock of Green Mountain. The latter company stated it would not consider any proposal of merger until it had completed its own recapitalization plan.

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Washington Court Rules in PUD-Newport Case

There is no law preventing two municipalities from constructing and operating separate electric distribution systems in the same area on a competitive basis, the Washington Supreme Court has ruled in a suit brought against the town of Newport by the Pend Oreille PUD.

Despite the fact that Newport is served by the PUD, people of the town voted to build their own electric system at an estimated cost of $200,000. As the town began to issue revenue bonds, however, the PUD went into court to halt construction of a competing system.

The court ruled the town election invalid because improper notice was given voters, and enjoined Newport from going ahead with its plan until the proposition has been submitted to the voters "at an election duly and legally called for that purpose." It also ruled "there is no provision in the statute even intimating that a city or town which has been included within a PUD is thereby deprived of the power granted it . . . to acquire or construct its own utilities."

The decision might have application in the current controversy over PUD acquisition of Washington Water Power Co properties within Spokane. Should the PUD's acquire the property from the American Power & Light Co, the city would be free to construct and operate its own system, if it chose to do so.

FINANCIAL BRIEFS

Electric and gas production and sales of Consolidated Edison Co of New York for 1950 were the highest in the history of the company. Electric sales rose 8.8% over last year to slightly over 11 billion kwhr and gas sales increased 7.5% to 60 billion cu ft.

Union Electric Co of Missouri has received SEC authorization to acquire 1,200 shares of $1 par common and 123,800 of income debentures of Urban Redevelopment Corp of St. Louis. The corporation is being organized to clear, replan, reconstruct, and rehabilitate blighted areas of the city.

Niagara Mohawk Power Corp has asked the New York Public Service Commission permission to absorb Frontier Development Corp, a wholly owned subsidiary owning power rights along the St. Lawrence River. Frontier holds some 4,000 acres along the river near Massena. The parent company said consolidation would make possible federal tax savings.

Electric Utility Financing—March 24-31

Company	Description	Amount of Offering (000)	Offering Price	Yield at Price to Public
Bonds				
Consumers Power	1st mtg 31/8s 1981 ref and new money	$40,000	101.467%	3.05%
Common Stock				
American Gas & Electric	339,674 sh new money	17,748	52.25	5.74
Detroit Edison	850,000 sh new money	17,000	20.00	6.00

SCHEDULED FOR FOLLOWING WEEK

Bonds—Potomac Edison, 1st mtg and coll tr 1981 new money, $10 million; Worcester Country Electric, 1st mtg "B," 1981 new money, $12 million.
Preferred Stock—Wisconsin Power & Light 10,000 sh ($100 par) new money, $1 million.
Common Stock—Southern Co, 1 million sh new money, $10.5 million; Duke Power, 126,255 sh new money, $9.5 million; Oklahoma Gas & Electric, 215,380 sh new money, $4 million; Wisconsin Power & Light, 96,069 sh new money, $1.5 million.

MEETINGS

Illuminating Engineering Society
Southern Regional Conference, Atlantis Hotel, Miami Beach, Fla., April 9-10.

Indiana Electric Association
Young Men's Utility Conference, Ipalco Hall, Indianapolis, April 10-11.

Southeastern Electric Exchange
Annual Conference, Boca Raton, Fla., April 11-13.

American Institute of Electric Engineers
District No. 4 Meeting, McFadden-Deauville Hotel Miami, Fla., April 11-13; District No. 1 Meeting, Hotel Syracuse, Syracuse, N. Y., May 2-4; District No. 5 Meeting, Loraine Hotel, Madison, Wis., May 17-19; Summer General Meeting, Royal York Hotel, Toronto, Canada, June 25-29.

Northwest Public Power Association
Annual Convention, Cascadian Hotel, Wenatchee, Wash., April 12-14.

Rocky Mountain Electrical League
Annual Spring Conference, Shirley Savoy Hotel, Denver, Colo., April 15-18.

Edison Electric Institute
Transportation Committee, jointly with American Gas Association Motor Vehicle Committee, Peabody Hotel, Memphis, Tenn., April 16-18; Purchasing and Stores Committee Annual Conference, Lord Baltimore Hotel, Baltimore, Md., April 30-May 2; Transmission and Distribution Committee, Edgewater Beach Hotel, Chicago, May 1-2; Meter and Service Committee, jointly with Association of Edison Illuminating Companies' Committee on Metering and Service Methods, Huntington Hotel, Pasadena, Calif., May 7-9; Commercial Electric Cooking Conference, Sheraton Hotel, Chicago, Ill., May 9; EEI Accident Prevention Committee, Hotel Utah, Salt Lake City, Utah, May 21-22; Electrical Equipment Committee, Hotel Biltmore, Los Angeles, Calif., May 28-29; Annual Convention, Shirley Savoy Hotel, Cosmopolitan Hotel, Denver, Colo., June 4-7.

Michigan Municipal Utilities Association
Spring Meeting, Wenonah Hotel, Bay City, Mich., April 19-20.

Northwest Electric Light & Power Association
Engineering Section, Hotel Utah, Salt Lake City, Utah, April 25-27; Business Development Section, Multnomah Hotel, Portland, Ore., May 7-9; Personnel Section, Davenport Hotel, Spokane, Wash., May 16-18.

Pennsylvania Electric Association
Communications Committee, Bedford Springs Hotel, Bedford, Pa., May 3-4; Joint Meeting of Electrical Equipment, Transmission and Distribution Committees, Abraham Lincoln Hotel, Reading, Pa., May 10-11.

New Jersey Utilities Association
Spring Meeting, Seaview Country Club, Absecon, N. J., May 4.

American Public Power Association
Annual Convention, Read House, Chattanooga, Tenn., May 7-9.

New York Society of Professional Engineers
Engineering Industries Exposition, Hotel Statler, New York, May 10-12.

Missouri Valley Electric Association
Accounting Conference, President Hotel, Kansas City, Mo., May 17-18.

Public Utilities Advertising Association
Annual Meeting, Hotel New Yorker, New York, May 17-19.

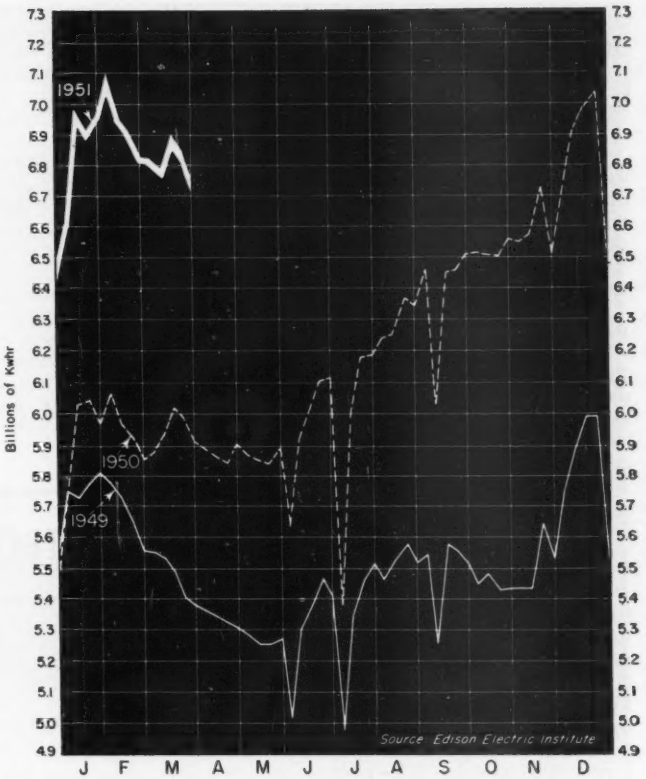
Protective Relay Engineers
Annual Conference, Georgia Institute of Technology, Atlanta, Ga., May 18-19.

Missouri Association of Public Utilities
Annual Convention, Jefferson Hotel, St. Louis, Mo., May 21-23.

Pacific Coast Electrical Association
Annual Convention, Biltmore Hotel, Los Angeles, Calif., May 21-23.

American Society of Mechanical Engineers
Semi-Annual Meeting, Royal York Hotel, Toronto, Canada, June 11-15.

Canadian Electrical Association
Annual Convention, Algonquin Hotel, St. Andrews, New Brunswick, June 18-21.



Output Week Ended March 31—6,767,344,000 Kwhr

Weekly Output, Millions Kwhr

1951		1950		1949	
Mar 31	6,767	Apr 1	5,912	Apr 2	5,378
Mar 24	6,848	Mar 25	5,993	Mar 26	5,404
Mar 17	6,903	Mar 18	6,015	Mar 19	5,496
Mar 10	6,795	Mar 11	5,937	Mar 12	5,531
Mar 3	6,822	Mar 4	5,879	Mar 5	5,552
Feb 24	6,833	Feb 25	5,854	Feb 26	5,559
Feb 17	6,905	Feb 18	5,931	Feb 19	5,650
Feb 10	6,957	Feb 11	5,971	Feb 12	5,722
Feb 3	7,099	Feb 4	6,062	Feb 5	5,778
Jan 27	6,970	Jan 28	5,972	Jan 29	5,810

Percent Change from Previous Year

	Mar 31	Mar 24	Mar 17
New England	+12.8	+12.3	+13.8
Mid-Atlantic	+10.8	+11.7	+13.0
Central Industrial	+14.5	+15.2	+16.8
West Central	+13.4	+13.5	+13.3
Southeast	+15.8	+17.1	+16.3
South Central	+19.7	+21.4	+21.1
Rocky Mountain	+ 9.7	+ 8.9	+ 8.5
Pacific Coast	+18.0	+12.4	+11.8
Total United States	+14.5	+14.3	+14.8

Depa Passes 1st Hurdle, Consultant Tells Group

Defense Electric Power Administration "has passed its first hurdle" in setting up a program for the electric utilities, Chandler E. Jones, president of the Northampton (Mass.) Electric Lighting Co. and consultant to Depa's Materials and Equipment Division, told the annual meeting of the Tennessee Valley Public Power Association March 30 at Knoxville.

In one of the first public statements by a Depa official, Jones predicted that "under orderly procedures and systematic controls the electric power program will go forward on a sound basis."

The New England utility executive, who served with the War Production Board in World War II, declared, "Having had personal experience in defense work during the last war, I have no doubt about our ability to do the present job. We did it then; we can do it again.

"There will be times, I suspect, when the shoe will pinch," he warned, "but thus far we have stepped on nobody's toes very heavily, and no one has been hurt."

He also explained how Depa could aid utilities.

WASHINGTON COMMENT

RONALD D. ROSS

Secretary of Interior Oscar L. Chapman's decision to let the Rural Electrification Administration run its own defense program outside of Interior's Defense Electric Power Administration could have a bright side for the electric utilities and the nation's power program. It could speed the seemingly inevitable day when Depa is taken out from under Chapman and Interior.

The REA-Depa dispute began several months ago. REA was successful in getting the National Production Authority to give it rations of copper and aluminum. REA cut the pie and distributed the pieces in the form of DO's for its "family." Depa officials weren't pleased with this power mobilization operation outside their province, but they were in no position to complain in December and January when Depa was just getting into operation. Too, there was an assumption that when Depa did get its program into operation, REA-financed systems would be included.

Depa Called Device of Private Companies

REA quickly developed other ideas. REA Administrator Claude Wickward and his assistant administrator, William C. Wise, charged at the recent National Rural Electric Cooperative Association convention that Depa was a device of the privately owned utilities and a threat to REA's generating and transmission program. This argument ignored the fact that Chapman was in charge of Depa, but it did build up some political pressure.

What REA asked was that whatever amounts of materials might be available for its borrowers, their distribution be made by REA. Its real fear was for the big controversial "G & T" programs. They have been challenged in Congressional hearings, before regulatory commissions, and in the courts. Now Depa proposed to rule on their essentiality. Depa might be expected to decide that some of the more bitterly opposed projects be delayed at a time when materials were growing more scarce.

Bureaucrats Want to Control Co-ops

Chapman's position was difficult. There was the bureaucrats' innate resistance to losing some authority—controls for a thousand electric utility systems. And there was the weight of the arguments. After all, he, and not the power company officials did have the final word. Depa was going to distribute materials for Interior's power systems as well as the other private and public utilities.

But REA's arguments were not entirely foreign to Chapman. Some of the most controversial REA programs were those tied in with Interior's power expansion. Congress wouldn't let Interior build steam plants, but REA borowers could and did, aiding in no small way the expansion of Interior's power program.

Chapman decided to call in a sort of examiner or arbiter to help him with his verdict. The assignment was handed Dr Paul Raver, administrator of the Bonneville Power Administration.

"Judge" Raver, whose BPA empire includes many REA-financed systems, listened to the arguments of both REA and Depa officials. He recommended that REA have its way. Chapman has agreed and is urging NPA to give REA its own share of materials in the second quarter, separately from Depa.

REA's victory may be short-lived. NPA, as this is written, has not formally approved Chapman's reluctant recommendation. Defense Mobilizer Charles E. Wilson might even step in and veto the arrangement. And it's only for the second quarter. Controlled Materials Plan may not provide for any such division of electric power responsibilities.

Certainly, though, this scheme for weakening Depa by cutting off its control over a quarter of the nation's electric systems more or less is a real argument for getting Depa out of Interior. A vigorous program of supporting and aiding the vital expansion of our electric generating capacity cannot emerge from crippling bureaucratic battles. In short it will not evolve in the Department of Interior.

TECHNICAL NOTES

ARCHER E. KNOWLTON

(*Adapted from papers and discussions at recent National Association of Corrosion Engineers convention in New York.*)

Turbine blade corrosion during standby periods may result from steam in-leakage and siphoning through drain lines.

Bare copper ground mats for station and substation protection can, unless prevented, cause galvanic injury to other buried metal structures.

Deteriorated tower legs can be identified by the regime of measured potential gradients along the transmission circuit.

Impedance per volt is an instrumental variable that often results in as many indications as there are meters. High and low impedance have their advantages and disadvantages. An answer is still to be found.

Burial to the four foot depth as required by U. S. Engineers protects a sea water crossing against marine growth, but tar or calcareous coating gives added assurance.

Magnesium ribbon is deemed better than cast anodes for cathodic protection in high resistance (15,000 ohm-cm and up) soils.

Cathodic protection is the consensus even for coated pipe laid in river crossing in preference to bare pipe with extra heavy wall for endurance against galvanic attack.

Stress relief after welding and prestressing for enhanced yield strength may possibly accentuate corrosion-stress cracking of buried pipe, but proof awaits more experience.

Bonding corrects differential potentials when two parallel underground structures cause interchange of drainage currents at numerous points.

Today's National Emergency Confronts Power Companies With Need For Preparedness Against the Threat of Enemy Action

Continental United States has come through recent wars pretty much unscathed. Both World Wars were 99% external. But the impending war could be vastly different. The difference lies in the fact that (1) Infiltration and sabotage will be greatly intensified and (2) today's weapons are more destructive. The new technology of warfare removes a large chunk of the former assurance that distance would protect the U. S. Distances have shrunk and bombs have grown.

Direct enemy attack is a possibility. In examining that possibility it must be recognized that effort might be made to destroy as many vital facilities as practicable. Such attacks would be without warning and occur simulatneously or at close intervals. Distances that the enemy must travel would limit weapons to the most effective ones. Because the atomic bomb is the most effective known weapon its use must be expected.

Every area of industry concentration is now a strategic target. Some sections are alive to the potential danger, others are apathetic. Half the population live in vulnerable areas, the other half dreams they are immune.

To be secure against such an attack, utilities must be prepared not only with adequate capacity, adequate manpower, loyal employees and adequate supplies but with:

1. An organization for restoration, adequate vehicles and construction tools
2. Adequate communication
3. Protection against sabotage
4. Protection against espionage
5. Knowledge of effects of the atomic bomb
6. Well-geared coordination with civil defense

In the pages that follow an attempt is made to examine these various aspects of preparedness with particular emphasis on their meaning to utilities of the United States.

PLEASE TURN THE PAGE ▶

Guard Against Disruption, Inside and Out

Any power company fortunate enough to have escaped major devastation in its area by flood, storm, ice or fire that today does not have an emergency organization plan should set one up. The pattern for the national emergency need not be substantially different from that employed by other companies to meet what they are beginning to think of as normal emergencies. Once set up it should be tested for its adequacy.

PLANNING is the key to preparedness against atomic attack. Keep plans flexible

As the result of a hypothetical bombing of Chicago the Commonwealth Edison Co concluded that to be prepared for atomic attack a utility should:

1. Have a thorough plan for meeting atomic attack
2. Disperse all trucks, tools, equipment and supplies essential to system operation
3. Shape and keep the plan flexible
4. Try out the plan after it's organized
5. Set up a personal call-out system to man repair teams and their headquarters
6. Provide ample emergency supplies
7. Establish at least one alternate headquarters
8. It is futile to call up company personnel until the "all-clear" has sounded and a survey of damage has been compiled.

Utilities will generally learn of the existence of disruptions before the civil defense group does. Utility crews will be on the way and possibly at work while the civil defense crews assemble and swing into action. This immediate situation presents a superb opportunity for friction unless the responsibilities have been spelled out beforehand.

Even more critical can be the aftermath period when wholly logical moves initiated by power crews may clash with those conceived by well-intentioned but misguided zealots who may conceivably try to rectify everything at once. The best answer to this phychologically natural tendency is to have the power company's emergency plans so completely formulated and strategically distributed that reference to them will forestall the possible conflict of opinion.

Communication . . . Floods, hurricanes, glaze storms and other area catastrophes have taught the power companies that system-wide communication is indispensable. It facilitates prompt removal of hazardous conditions, prompt restoration of essential services and as promptly as is possible to the general public. Almost universal experience has been, however, that no utility has found itself with truly ample communication facilities.

But they should be fully safeguarded against subversive action and against commando-like seizures or interference. Nor should the facilities be taken over or controlled by Civil Defense agencies. They are too vital to the continuance and restoration of electric service for such essential services as lighting, sirens, radio, broadcasting and receiving, water pumping, etc.

This point has been confirmed in a recent resolution of the National Committee for Utilities Radio which states that "each utility will require the fullest use of its radio facilities in performing its own work and that no plans should be made which contemplate the use of any radio system in the Power Radio Service for general civil defense purposes".

Sabotage . . . In spite of development of long range aircraft and missles, the difficulties of attack would be great. This suggests that a potential enemy would use full scale efforts to infiltrate industry and destroy our will and ability to fight. Mass sabotage prior to or during military attack may be an important tool for destruction of vital industry.

Sabotage may take these forms:

1. Damage to buildings and equipment by explosives,

GUARDS are the main safeguard against sabotage and false entry. Use stationary guards at unlocked entrances to vulnerable areas; roving guards on patrols around plants

fire, breakage, abrasives and chemicals

2. Malicious and surreptitious interruption of plants or their auxiliaries
3. Tampering with relays, instruments, test facilities
4. Altering of instruments for emergency operation
5. Disablement of communication
6. Polluting or infecting of food, air, water
7. Creation of hidden hazards to personnel or equipment
8. Foreign objects in lubricating oil, fuels
9. Scrambling of sorted stocks
10. Fomentation of strikes, slowdowns, fear

Guards will be the principal safeguards against false entry to plants. Fences, locks and bars only delay a determined intruder. Proper lighting will be a deterrent.

Stationary guards are required at all unlocked entries to vulnerable areas.

Roving guards should make systematic but non-scheduled patrols around the plant and around the clock. Fences, gates, entering trucks and railroad cars should be checked.

Guards should have no other duties than maintenance of plant protection except in conjunction with fire fighting, etc.

Parking lots should be external to the plant enclosure or a fenced-off segment of it. Visitors should be required to park outside the employee parking area. All employees and visitors should enter only by pedestrian entrances and after inspection of their credentials.

Espionage . . . Espionage is the foundation on which all enemy action is based. Accurate information may mean success; lack of it may lead to false estimates of the situation and failure.

Enemy agents want information on industry which will lead to an evaluation of our war potential and information that may be used to advantage in sabotage and attack.

Typical information sought by spies is:

1. Capacity data
2. Drawings and details of plants and systems
3. Location of key control centers, fuel stocks, substations
4. Means of access despite guards and fences
5. Customary routes of transit of new equipment, fuel, working staffs
6. Points of most effective sabotage
7. Means of circumventing protective measures
8. Ferreting of potential inside accomplices

Espionage agents ingeniously cultivate such sources of information and technique as:

1. Infiltration as employees, inspectors, bogus employees
2. Buying, stealing or sneaking information from employees
3. Stealing information from files and records
4. "Borrowing" and reproducing drawings and records
5. Relying on friendly "front" organizations to obtain fragments for integration into strategic information
6. Using threats of danger to relatives of employees
7. Adroit elicitation of information from employees or their relatives

Espionage may be rendered relatively ineffective by:

1. Careful check of personnel, particularly before employment

Regulatory Advice to Utilities

New York Public Service Commission Chairman Feinberg in a recent article said:

"Utilities have to cope with emergencies in normal operations and . . . have developed apparatus and trained personnel skilled in dealing with emergencies. The same basic procedures . . . would be followed in overcoming any interruptions to service caused by enemy action . . . Any defense emergency would be treated by the utilities in the same fashion as any other situation demanding prompt action . . . Such action would take place immediately under the normal procedure . . . without need for any direction from defense authorities other than an indication of general priorities to be followed.

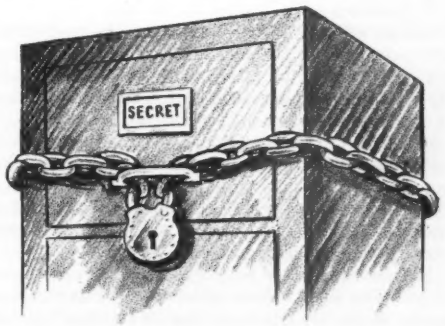
"Utilities can and will help unmeasurably in defense matters but they also need and should have the help of other agencies . . . There is a danger which looms rather large in the minds of utility operators . . . Any auxiliary force should cooperate only under the direct supervision of personnel employed by the utility . . . Uniformed interference . . . may result in widespread confusion, delay and hazards to life and property."

2. Prevention of unauthorized entry
3. Special guarding and handling of critical information
4. Restriction of movements of employees
5. Alerting employees to the risks of espionage and sabotage

Assurance of loyalty of utility employees in vulnerable positions is of extreme importance in defense.

Identification means should enable all employees to recognize a stranger or a "roamer." Badges should carry a photograph and be tamper-proof. Issuance should be safeguarded against counterfeiting or loss. Special and distinctive passes or badges should be issued to authorized visitors. A clever intruder will be detected only by a minor defect and alert inspection is therefore essential if the full measure of security is to be realized against a determined and resourceful enemy agent.

Suspected espionage agents or subversives should be reported to the Federal Bureau of Investigation. But do not burden the FBI with idle rumors nor try to make your own investigations. Inept quizzing may destroy the chance for effective handling as well as alienate the loyalty of innocent persons.



LOCKS ALONE are not enough protection against determined spies. Careful, alert and loyal employees provide the best security against infiltration and espionage

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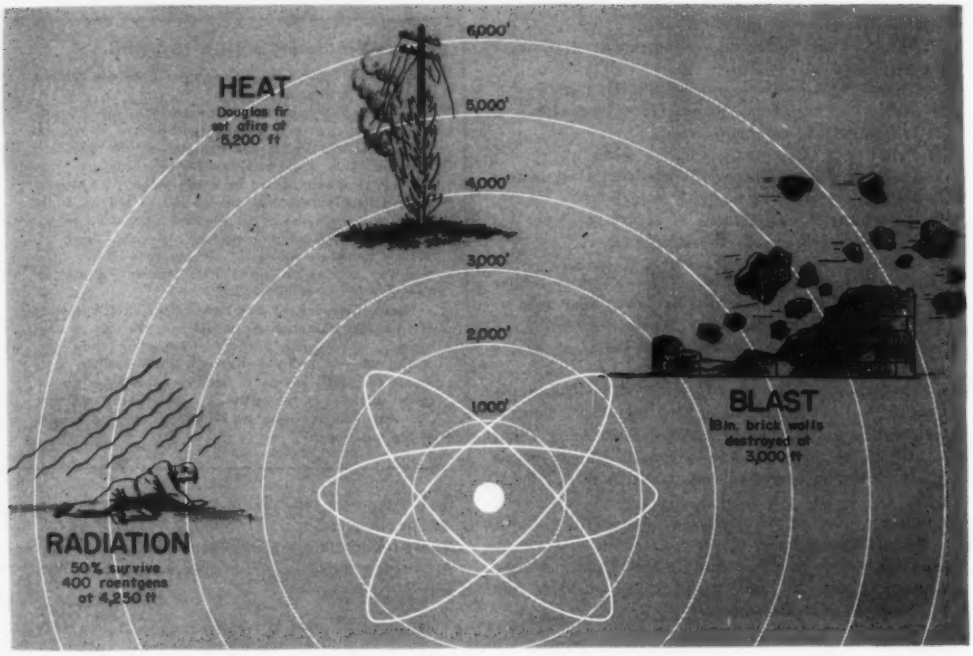


ATOMIC EXPLOSIONS release energy in three ways. Destruction at different distances from center of blast are depicted

Know What A-Bombs Can Do

The atomic bomb differs from all previous weapons in the terrific amount of energy released in the explosion. Further this energy appears in three forms—heat, pressure and radiation. All effects of the bomb can be referred directly to one or more of these kinds of released energy:

1. Heat, probably exceeding, for at least 3 sec, a temperature of 6,200 F at ground directly beneath explosion.
2. Blast or pressure wave
3. Radiation

It is the part of wisdom to base our defense and restoration techniques on the premise that any Russian bombs will equal the 20,000-ton TNT equivalence of our nominal Hiroshima bombs assumed to contain a kilogram (2.2 lb) of uranium 235 or plutonium effectively fissioned.

One third of the released energy is in the form of an intense heat wave travelling with the speed of light. About two-thirds spreads out as a shock wave.

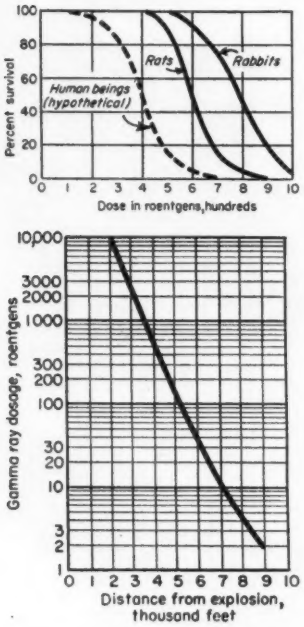
The shock wave after 10 sec will have moved about 12,000 ft; at 30 sec it has reached 36,000 ft but almost all its energy has been dissipated.

The incident pressure peak of the blast wave is taken as 15 psi. This is enough to cause structural damage to a modern windowless, reinforced concrete building. The pressures drops to zero in ½ to 1 sec and is followed by a reversal of pressure for several seconds. Wind pressures at hurricane velocities are much less than 1 psi.

Heat Energy from Atomic Explosion at Various Distances

Material	Effect	Critical energy	Effective distance	
		Calories per sq. centimeter	Clear day Feet	Very clear Feet
Skin	Moderate burns	3	8,400	10,000
	Slight burns	2	9,600	12,000
	Chars	8	6,000	7,000
White paper	Burns	10	5,400	6,300
Black paper	Burns	3	8,400	10,000
	Chars	8	6,000	7,000
Douglas fir	Burns	11	5,200	5,900
Douglas fir (stained dark)	Burns	3	8,400	10,000
	Chars	7	6,300	7,300
Philippine mahogany	Burns	9	6,150	7,150
	Chars	8	6,000	7,000
Maple (black)	Burns	25	3,800	4,300
	Scorches	8	6,000	7,000
Cotton Shirting (gray)	Burns	10	5,400	6,300
	Scorches	10	5,400	6,300
Cotton twill	Burns	17	4,400	5,100
	Brittle	7	6,300	7,300
Gabardine (green)	Burns	10	5,400	6,300
Nylon (olive drab)	Melts	3	8,400	10,000
	Scorches	3	8,400	10,000
Rayon lining	Burns	8	6,000	7,000
	Nap gone	2	9,600	12,000
Wool serge (dark blue)	Loose fibers burn	7	6,300	7,300
	Nap melts	4	7,600	9,100
Worsted (tropical khaki)	Burns	15	4,700	5,400
Rubber (synthetic)	Burns	8	6,000	7,000
Lucite	Softens	72	2,300	2,400
Bakelite	Chars	75	2,300	2,400

Gamma Radiation Dosage And Percent Survival



AIR BLAST DAMAGE: JAPANESE EXPERIENCE

Wind velocity (miles per hr.)	Duration (sec)	Peak pressure (psig)	Miles	Feet	Damage
					Limit of light damage at 8 miles.
50	1.25	1.5		12,000	Light damage to window frames and doors, moderate plaster damage, complete window damage.
			2.25		
60	1.23	1.7		11,000	Flash charring of telegraph poles. Roof and wall covering on steel frame building damaged.
			2.0		Partial damage to structures in area.
70	1.20	2.0		10,000	Blast damage to majority of homes. Severe fire damage expected. Flash ignition of dry combustible materials.
			1.75		
80	1.15	2.4		9000	Heavy plaster damage.
					Moderate damage to area.
100	1.12	2.9		8000	Severe damage to homes, heavy damage to window frames and doors, foliage scorched by radiant heat.
			1.50		
125	1.06	3.6		7000	
					Structural damage to multistory brick buildings.
			1.25		
160	0.98	5.2		6000	Severe damage to entire area. Severe structural damage to steel frame building. 9-inch brick walls moderately cracked.
					Electrical installations and trolley cars destroyed. Multistory brick building completely destroyed.
			1.0		
200	0.90	7.4		5000	12-inch brick walls severely cracked.
					Steel frame building destroyed (mass distortion of frame). Light concrete buildings collapsed.
270	0.77	10	0.75	4000	Reinforced concrete smoke stack with 8-inch walls overturned. Roof tiles bubbled (melted by heat).
					18-inch brick walls completely destroyed.
380	0.62	16		3000	
			0.50		Virtually complete destruction of all buildings, other than reinforced concrete earthquake-resistant design.
550	0.45	24		2000	Limit of severe structural damage to earthquake-resistant reinforced concrete buildings. Reinforced concrete building collapsed, 10-inch walls, 6-inch floor.
					Mass distortion of heavy steel frame buildings. Loss of roofs and panels.
			0.25		
800	0.37	36		1000	Decks of steel plate girder bridge shift laterally.
				0	"Ground zero" for Air Burst of an Atomic Bomb.

Weakest structures from standpoint of shock resistance are shed-type commercial buildings with light frames and long spans of unsupported beams.

Major structural damage will occur within a mile from the ground-zero. Within a two-mile radius damage will range from severe to destructive.

Typical multi-story American structures would be much less resistant to collapse than those in Japan designed for earthquake resistance. However, tall buildings with heavy steel frames and a long period of vibration should withstand well.

Load-bearing walls are particularly vulnerable.

Reinforced concrete smokestacks stood the Japanese bombings well.

Radiation . . . Six effects radiate from the center of detonation of the bomb.

1. Alpha radiation
2. Beta radiation
3. Neutron radiation
4. Gamma radiation
5. The shock wave
6. Thermal radiation

The first two do not reach the ground from a high air burst. A person close enough to be harmed by neutron projectiles would be killed by the gamma rays. An overdose of gamma rays would prove fatal. Fortunately the effects shrink to 50% in the first second. These gamma rays will probably be comprehensively lethal within a one-half mile radius.

Thermal Radiation . . . After 100 millionths of a second the ball of fire has grown to a 90-foot diameter with a temperature of 500,000 F. In 15 thousandths of a second the ball is 600 ft wide with a surface temperature of 9,000 F. The heat rays weaken in accordance with the inverse square law but surfaces on which they impinge near the ground-zero rise to high temperatures and ignite if they are combustible.

WRECKED SUBSTATION was located only 650 ft from the bomb center. Original brick building housed converters and mercury arc rectifiers that supplied the Hiroshima trolley system. The building was completely destroyed and burned out

Utility System Lessons from Hiroshima

What an atomic bomb could do to the system of an electric utility in this country can be judged from what it did to the electric system of the Chugoku Electric Supply Co, Ltd, in Hiroshima. Two American engineers, Van Duzer and Burger, who served in a mission to Japan as consultants to the Secretary of War, have reported the damage to the Hiroshima utility in detail.*

They conclude that, although destruction to an American system would be widespread, underground transmission systems would be largely spared. Modern fireproof building construction would prevent fire following the explosion from spreading to adjacent wood poles. And, except within a mile of the blast center, the reinforced concrete and heavy brick construction of American-designed substations and generating stations would stand them in good stead. Fire, rather than bomb blast or heat radiation, would probably create the greatest havoc.

Briefly summarized, these are conclusions reached in the reports:

1. Radioactive substances did no damage to the electric facilities of the utility system.

2. Underground cable systems were undamaged, except at terminals.

3. Bulk of the damage to wood pole distribution lines was caused by fire that, in the majority of cases, communicated from adjacent inflammable buildings.

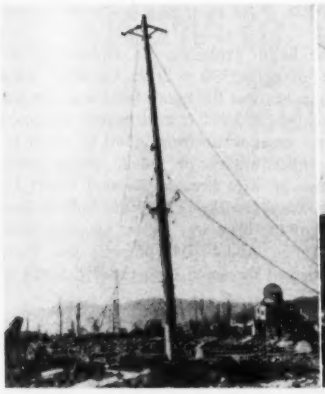
4. Latticework steel poles were particularly vulnerable to damage at distances up to 6,000 ft from the bomb center.

5. Reinforced concrete poles survived the blast best of all.

6. Distribution conductors in the smaller sizes were cut, broken or burned up to a mile and a half from the blast. Larger sizes suffered the least damage.

7. Only 10% of the line insulators were damaged by the bomb blast. There was no damage by bomb force

*"Japanese Appraisal of Atomic Bomb Damage to Hiroshima Utility System." R. M. Van Duzer, Jr, chief operating engineer of power plants, the Detroit Edison Co, and E. J. Burger, vice-president, Ohio Public Service Co (now Ohio Edison Co). "Electrical World," Nov. 8, 1947, pp 98-104.



CONCRETE POLES like this one stood the blast from the atomic explosion in all but one case out of 24. This one was 650 ft from bomb center

STEEL POLES FAILED in 75% of the cases. This one was 6,000 ft from the bomb center. Note that nearby concrete poles remain undamaged

WOOD POLES suffered most from fire. To 8,200 ft, over half were destroyed thus. This pole at 3,280 ft was canted, transformer jarred loose

beyond a mile. Bulk of insulator damage inside a mile radius was by fire and failure of supports.

8. Damage to pole-top transformers and switches was extensive within a mile from the blast. Most of it was caused by fire and jarring of units from poles.

9. Fire caused the major damage to plants and substations. These, in many cases, had wooden roofs.

10. Brick and reinforced concrete plant structures a mile or more from the blast stood up well. The interior was burned out in most instances because of wooden roof construction. A brick substation 500 ft from the bomb center was completely demolished.

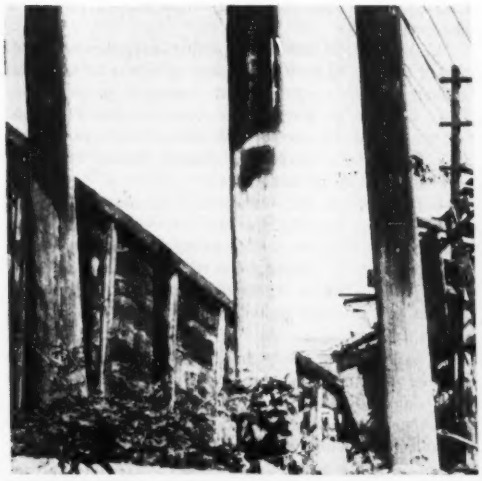
11. The utility company's five-story reinforced concrete office building, located within a half-mile of the bomb center, was completely burned out. Of the 340 employees, 34 were killed immediately, 44 died of injuries, and 78 were seriously injured.

12. The building itself was not completely destroyed. The reinforced concrete construction of the walls, ceilings and roof prevented total collapse. Thus, it was possible to make temporary repairs and reoccupy the building at a later date.

13. Electric supply lines were totally destroyed by the bomb blast and the fire that followed.

14. Iron and steel poles were destroyed through structural collapse. Only reinforced concrete poles survived, comparatively undamaged.

15. Major damage to wood poles was caused by the



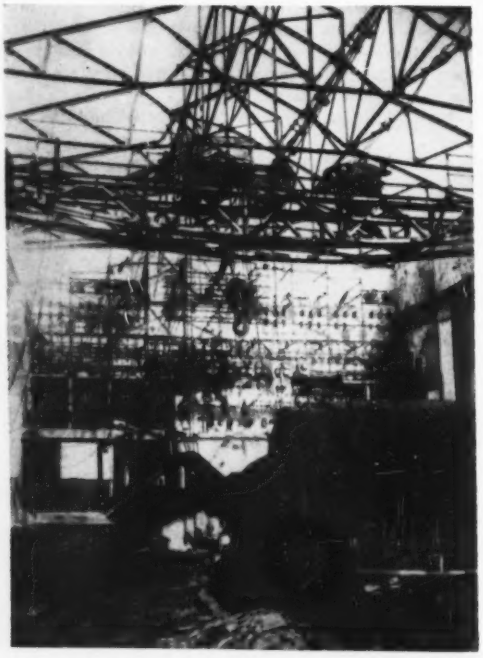
FLASH BURNS on wood poles 6,200 ft from ground zero. Uncharred portions were protected from heat by fence at left

SHADOW OF RAILING cast by thermal radiation is etched in the asphalt bridge floor. Roof tile was also blistered

LATICE WORK POLES bent 3 to 6 ft above ground when blast force was in direction of line; 3 to 12 ft when blast was perpendicular. This pole was 3,280 ft from ground zero

spreading fire that followed the bomb explosion. The radiation of heat from the bomb and the force of the bomb blast did relatively little damage to the wood poles. Virtually all wood poles were burned down. Poles near the bomb center were only slightly damaged by heat radiation, since they were almost directly under the radiation which came down very nearly vertically.

16. Between 10 and 20% of the poles between 1,650 and 5,000 ft from the blast center were harmed by heat radiation. From 5,000 to 8,200 ft, poles were superficially burned by heat radiation to a depth of 1 to 3 mm. Beyond 8,200 ft, poles escaped damage from heat radiation.



FIRE at this generating station at 8,000 ft followed bomb blast. It completely destroyed the building and equipment

17. Force of the bomb explosion did relatively little harm. About 10% of poles 330 ft from the blast were slightly damaged, this because the bomb force was exerted vertically. Poles from 300 to 3,000 ft were heavily damaged in about 30% of the cases while from 3,300 to 6,600 ft, about 10% were either broken or felled. Many poles were canted because of wire breaks. Beyond 6,600 ft, relatively few poles were leaning. Observers believe that at a mile the force of the blast was almost identical with typhoon wind pressures. About 70% of poles that were broken or felled failed at the foot; 20% failed 6 to 10 ft above ground.

18. Fire damage was extensive. Practically all poles 15 ft from buildings and houses were burned, regardless of their distance from the bomb center. The degree of fire damage to the wood poles varied with wind direction, type of adjacent buildings and distances from buildings, as might be expected.

19. Of steel poles, about 75% failed under the force of the blast within 6,600 ft of the center of explosion. About 95% of the steel poles in the 660- to 3,300-ft zone were completely damaged. At 6,600 ft, poles were seriously but not totally damaged. The safety zone for steel poles was beyond 8,000 ft.

20. Steel poles hit by the blast parallel to the line were bent over 3 to 6 ft from the ground; those hit at right angles to the line failed 3 to 12 ft from the ground. Bolt holes in the framework were the weak points.

21. Damage to the 24 reinforced concrete poles on the system was very slight. At 660 ft, one of two concrete poles was undamaged except for a small crack. The other was destroyed. At 6,000 ft all six poles were found to be undamaged.

22. Fire caused the bulk of the damage to line conductors. Damage decreased with distance from the explosion. There was no damage beyond 10,000 ft. In the vicinity of the blast, however, wires 3.2 to 4 mm in diameter were down but those larger than 5 mm were undamaged.

23. Between 50 and 60% of line insulators were destroyed by fire; 20 to 30% because of failure of supports. Insulators directly damaged by explosion force totaled 10%. Little or no damage was caused by heat radiation. But fire caused the sulphur and cement bonds to become ineffective. Many insulators, although partly damaged, were still capable of being used.

24. Blast effects and fire damage accounted for most of the pole-top transformers and oil switches destroyed. Fire contributed to about 90% of this destruction. Many were damaged in falling from the pole when supports burned away. Within 3,300 ft, many transformers and switches fell or were dislodged. Beyond 5,000 ft there was no damage.

25. Underground cables, buried 2 to 4 ft deep, escaped virtually unharmed. But some were damaged at terminals or at connection boxes by the blast or fire from buildings. In these cases, insulating compound and lead sheaths were melted and insulating paper burned.

26. Damage to power stations was chiefly from destruction of buildings by bomb blast and damage to machines and equipment by fire.

How to Cut Low-Voltage Fault Current Calculations

These simple estimating curves for low voltage 60-cycle feeder systems minimize time-consuming calculations for evaluating magnitude of short-circuit currents. Lower rated fuses and breakers can be used remote from supply bus

R. H. KAUFMANN, Industrial Power Section, Industrial Engineering Divisions
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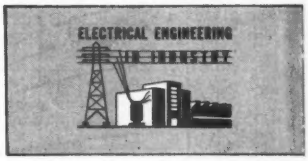


It is obvious that the possible short-current magnitude will be lower at points in the low-voltage feeder system remote from the power supply bus. Thus it should be possible to use, safely, lower interrupting current rated fuses and circuit breakers at these locations.

The application engineer is anxious to employ the lowest interrupting current (IC) rating in protective interrupters that will meet the short-circuit duty. Calculations normally required to evaluate the magnitude of short-circuit currents on low-voltage feeder circuits is a time-consuming task.

Presented here are simple estimating curves for low-voltage 60-cycle operation, (Fig 2 for cable feeders and Fig 3 for bus feeders) by which the effect of any particular length of common feeder circuit construction on the magnitude of short-circuit current can be evaluated quickly. The results are in terms of the three-phase average asymmetrical rms value during the first cycle corresponding with the basis of rating for low-voltage air circuit breakers. The effects of circuit resistance both in increasing the impedance and speeding the decay of the dc component have been included:

The range of operating conditions encompassed is:

System Operating Voltage (Nominal)

208Y/120 v, 3-phase, 4 wire, or 208 v, 3-phase, 3 wire; 480 v, 3-phase, 3 wire, or 480Y/277 v, 3-phase, 4 wire; 600 v, 3-phase, 3 wire

Fault-current Magnitudes

10,000 to 100,000 amp

Feeder Circuit Construction

3/C Cable—No. 4 Awg to 500 Mcm

Busway—Plug-in type 225 to 800-amp, (Trumbull Type FAP)

Low Voltage Drop type 2,000-amp (Trumbull Type LVD)

(Charts are applicable to feeders of other type or manufacture having specific impedances the same as those tabulated on the charts.)

Required Data

The basic data needed to permit a solution include:

1. System operating voltage
2. Available IC at the source bus (avg asymmetrical)
3. Length and construction of the feeder circuit
4. Connected motor load at the feeder terminal

Procedure

The evaluation of feeder terminal IC involves only four simple steps (see Fig 1)

1. Locate the magnitude of source-end IC on the proper left-hand operating voltage scale.

2. From this starting point move along to the right following along a curve or an interpolation between adjacent curves until the desired length of specific feeder construction (hori-

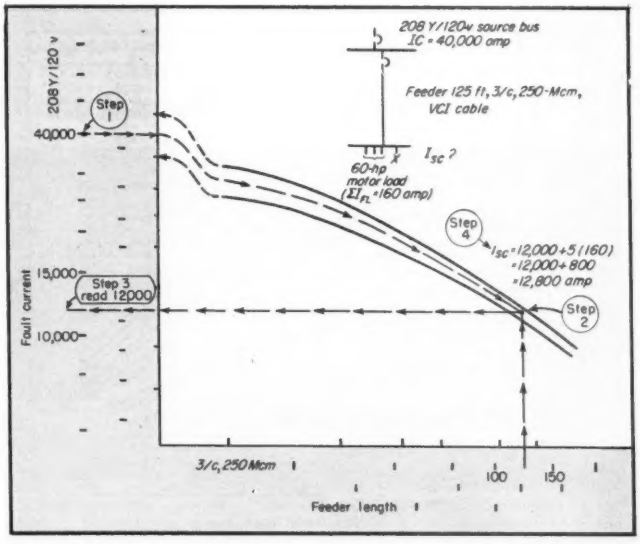


FIG 1—PROCEDURE for evaluating low voltage feeder terminal interrupting current

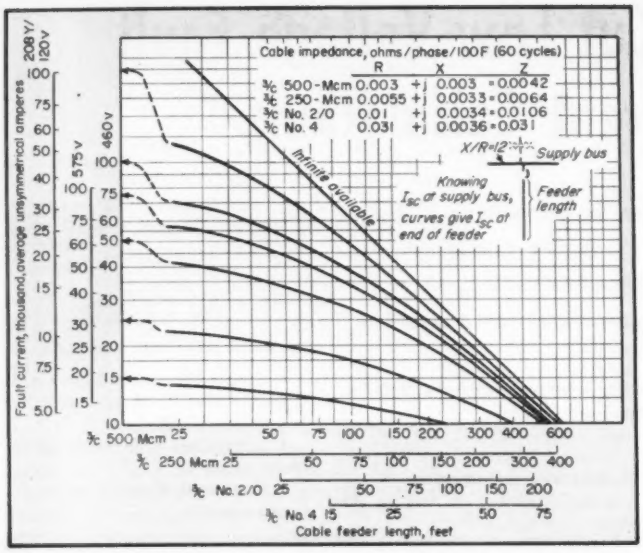

Cable impedance, ohms/phase/100 F (60 cycles)
R X Z
3/c 500-Mcm 0.003 +j 0.003 = 0.0042
3/c 250-Mcm 0.0055 +j 0.0033 = 0.0064
3/c No. 2/0 0.01 +j 0.0034 = 0.0106
3/c No. 4 0.031 +j 0.0036 = 0.031
X/R=12
Supply bus
Feeder length
Knowing I_{SC} at supply bus, curves give I_{SC} at end of feeder
Infinite available
Fault current, thousand, average unsymmetrical amperes
208Y/120v
460v
575 v
3/c 500 Mcm
3/c 250 Mcm
3/c No. 2/0
3/c No. 4
Cable feeder length, feet

FIG 2—LOW VOLTAGE FAULT CURRENT vs feeder length three-conductor cable in conduit or interlocked armor (60 cycles) estimating curves

zontal scales) is reached.

3. Project the latter point horizontally to the left and read the fault current contributed by the feeder on the same scale as used in (1).

4. Add the feeder terminal connected motor current contribution (five times the sum total motor full-load current).

Modifications for Special Conditions

(A) Parallel Circuit Feeders

A feeder circuit composed of two or more identical circuits in parallel can be readily treated by making a correction in the apparent length. The impedance presented by a feeder consisting of two circuits in parallel will be identical to that of a single circuit of half the length; that of three circuits in parallel will be identical to that of a single circuit of one-third the length, etc.

In the case of parallel circuit feeders, divide the true feeder length by the number of circuits in parallel and proceed on the basis of single circuit data.

(B) Feeders Consisting of Different Circuit Construction in Series

Make an independent evaluation of each common circuit construction starting at the source end.

1. Evaluate the IC at the end of the first section of common feeder construction in the standard manner.

2. Using the answer derived from (1) as the source IC value for section (2) proceed in the standard manner to evaluate the IC at the end of the second section.

3. Using the answer derived from (2) as the source IC value for the third section proceed in the standard manner to evaluate the IC at the end of the third section.

Results obtained for sections beyond the first will be somewhat on the conservative side (higher than the true IC value). This follows from the fact that the basic analysis assumes an X/R ratio of 12 at the source end of the feeder. The true X/R ratio at the source terminals of any feeder section beyond the first will necessarily be less than 12 since no feeder construction exhibts an X/R ratio as high as 12.

(C) Interpolation for Intermediate Cable Conductor Sizes

Specific cable feeder length scales have been inscribed for conductor sizes of 500 Mcm, 250 Mcm, No. 2/0 and No. 4. For intermediate values of cable size locate the horizontal scale points for the desired length of adjacent cable sizes which are charted, and interpolate between these values. For example a No. 3/0 conductor is about midway between a No. 2/0 and a 250 Mcm. To evaluate the effect of a 100 ft length of No. 3/0 cable (Fig 2) locate the 100-ft point on the 2/0 scale and on the 250 Mcm scale. A point midway between these two points will closely represent 100 ft of No. 3/0 conductor.

(D) Three Single Conductor Cables in Conduit

Results obtained from the estimat-

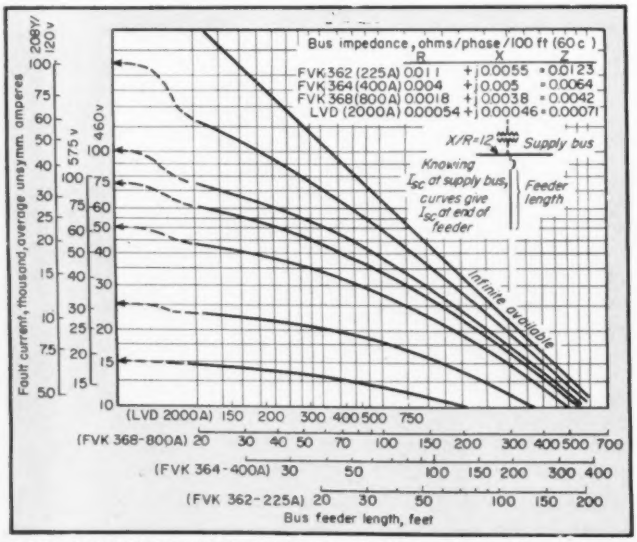

Bus impedance, ohms/phase/100 ft (60 c.)
R X Z
FVK 362 (225A) 0.011 +j 0.00555 = 0.0123
FVK 364 (400A) 0.004 +j 0.005 = 0.0064
FVK 368 (800A) 0.0018 +j 0.00338 = 0.0042
LVD (2000A) 0.00054 +j 0.00046 = 0.00071
X/R=12
Supply bus
Feeder length
Knowing I_{SC} at supply bus, curves give I_{SC} at end of feeder
Infinite available
Fault current, thousand, average unsymm. amperes
208Y/120v
460v
575 v
(LVD 2000A)
(FVK 368-800A)
(FVK 364-400A)
(FVK 362-225A)
Bus feeder length, feet

FIG 3—LOW VOLTAGE FAULT CURRENT vs feeder length bus (60 cycles)

ing curves without correction can be used to select protective interrupters.

If desired, a closer approximation of the actual value can be obtained by increasing the apparent feeder length to account for higher impedance of single-conductor feeder circuits.

Conductor Size	Use an apparent length of
500 Mcm	130% of the actual feeder length
250 Mcm	120% of the actual feeder length
No 2/0	110% of the actual feeder length
No. 4	No correction

Both the 60-cycle resistance and reactance of a three-single-conductor cable feeder in conduit is greater than that of a three-conductor cable feeder in conduit or steel armor in the ratios reflected in the following table:

Conductor Size	Resistance	Reactance
500 Mcm	125%	150%
No. 2/0	106%	150%
No. 4	102%	150%

Note: Spaced open-wire circuits should be treated by conventional calculation procedures

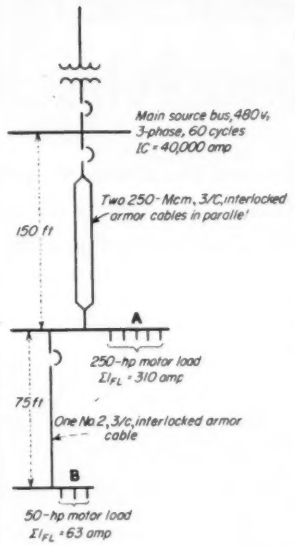
(E) Single-Phase Circuits

Results obtained from the curves may be used with safety for the selection of protective interrupters. The true IC value for a two-wire single-phase circuit operating at line-to-line voltage will be about 87% of the three-phase evaluation.

(F) Frequency

The curves included here are restricted to 60-cycle operation. For operating frequencies other than 60 cycles, conventional calculations should be used. Note that feeder circuit resistance is not appreciably affected by frequency while reactance varies directly with frequency.

Example of Application


Main source bus, 480 v, 3-phase, 60 cycles
IC = 40,000 amp
Two 250-Mcm, 3/C, interlocked armor cables in parallel
150 ft
A
250-hp motor load
ΣI_{FL} = 310 amp
75 ft
One No 2, 3/c, interlocked armor cable
B
50-hp motor load
ΣI_{FL} = 63 amp

IC at Bus "A"?
Source IC = 40,000 amp
Equivalent single cable feeder length = 150/2 = 75 ft
From curve Fig 2 (460-v IC scale; 250-mcm feeder length scale)
Contribution via feeder cable, amp = 23,000
Motor contribution, Bus A = 5 (310) ..... = 1,550
24,550
Motor contribution, Bus B = 5 (63) ..... = 315
IC Bus "A" ..... = 24,865

IC at Bus "B"?
Source IC for section 2 = 24,550 amp (say 25,000)
Feeder length = 75 ft
From curve (460-v IC scale; interpolate between the 75-ft point on No. 2/0 and No. 4 feeder length scales—No. 2 about one-thid of the way from No. 4 to No. 2/0.
Contribution via feeder cable, amp = 11,000
Motor contribution Bus B = 5 (63) ..... = 315
IC Bus "B" amp ..... = 11,315

High-Level Lighting Speeds Factory Shipping

High-level evenly distributed lighting of 40 ft-c speeds up the shipping and mailing activities of a new sewing machine factory in Bridgeport, Conn. Names and addresses can be identified quickly and easily. For maximum flexibility each one of the three-lamp fluorescent lighting fixtures is plugged into an individual ceiling outlet—allowing relocation of the units when desired.

Chain mounted and spaced on 8-ft centers, the fixtures contain 40-w, 3500-K standard white fluorescent lamps. Units have a wide distribution of light. They have open ends to aid cleaning and relamping. A total of 1,700 similar units were installed in this new five story factory.

Sylvania Electric Products Inc photo

FACTORY SHIPPING is stepped up with 40 ft-c of well-distributed light from three-lamp fluorescent fixtures on 8-ft spacing. Each fixture is plugged into an individual outlet for maximum flexibility. Lamps are 40-w, 3500-K standard white

To Reduce Replacements Treat Standing Poles

One above-ground spraying, two ground-line treatments and one retreatment every 16 years could give indefinite life to older cedar pole. Cost per pole is about $1.15 annually

L. E. LOCKWOOD, Supervisor of Distribution and Operating
Public Service Co of Northern Illinois, Maywood

FIG 1—GROUNDLINE of pole treated in 1940 had no additional rot in 1950. The pole, set in 1923, is sound

FIG 5—WIRE BRUSH was used to clean rot from pole in Fig 4. No additional decay was found in 1950

MARKED reduction in the utility industry's pole replacement requirements over a period of years can be achieved if standing poles are properly treated at regular intervals. Public Service Co of Northern Illinois reached this conclusion after treating approximately 200 poles in 1940 and examining some of them in 1950. It is estimated that, for an anual cost of about $1.15, a pole could be made to last indefinitely.

Results of Treatment . . . Poles treated were set from 1914 to 1923. Results on some of the poles can be seen in Fig 1, 2, 3 and 4. In Fig 1 the pole is sound with no signs of decay. Fig 2 shows some large checks above ground (arrow) with some shell rot. There are no pockets or signs of decay. The pole is sound. Fig 3 shows large pocket below ground. There were no signs of further decay and the condition of the pole was good. In Fig 4 several pockets that were cleaned from the first treatment can be seen. There was no additional decay and the pole was in good condition. As a result of the survey made in 1950 it was concluded that the company's re-treatment cycle could be safely extended from six to eight years.

In 1947 the company started a program of groundline treatment of poles. This treatment was applied to all poles set prior to 1928 with sufficient good wood at the groundline and at least eight to ten years expected remaining life on the portion of the pole above ground.

The preservative for ground-line treatment is a mixture of sodium fluoride, potassium dichromate, and dinitrophenol to which is added an approximately equal amount of coal tar creosote. The resulting mixture is a soft black paste which may easily be applied with a brush.

Treating Procedure . . . For the treatment of old poles, all earth for about 1 ft surrounding the butt and to a depth of approximately 20 in. is removed. All rotted wood is removed from the pole. The pole then is tested with an increment borer and the circumference measured to determine whether the remaining good wood has sufficient strength for the pole loading. If the pole meets these requirements it is considered a treatable pole. The paste is applied from 6 in. above groundline to 18 in. below groundline.

A bandage (18 in. wide) is wrapped around the pole extending from 2 in. above the groundline to 16 in. below groundline. Toxic salts in the preservative separate from the coal tar creosote and penetrate the wood wherever there is moisture or dampness, thus affording internal protection. The creosote remaining on the outside of the wood forms an oily preservative coat for external protection under the bandage. It is expected to extend the life of the pole at the groundline at least eight years with one treatment. After that the pole can be treated again.

The program for the past four years included a survey of the poles in the older sections of various towns in the company's territory. During this period 137,623 poles were surveyed. Of these, 69,703 were treated and 8,037 were rejected. Poles were rejected which were badly shell rotted, had woodpecker holes, or had insufficient good wood at the groundline.

Groundline Incising . . . Since 1927 new poles have had a treatment which consists of ½ in. incising over a 3-ft area so that 1 ft would be above the groundline and 2-ft below. This treatment was expected to last as long as the above-ground pole section.

A preliminary survey of 564 poles set in 1928 to 1932, inclusive, at the proper depth indicated 4.3% had decay pockets. However, there was a sufficient amount of good wood remaining which could be saved by treatment. Poles decayed to such a point that they had to be rejected amounted to 1.2%.

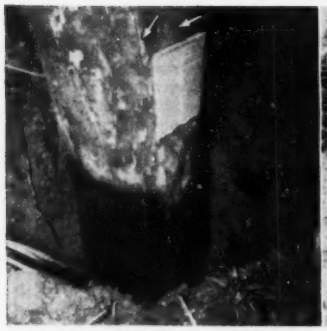


FIG 2—SHELL ROT and large checks above ground were found in 1950 on pole. However, it was judged sound

FIG 3—LARGE POCKET from 1940 treatment was found to be in good condition, with no decay, in 1950

FIG 4—POCKETS from treatment in 1940 were cleaned before retreatment. Pole was found in good condition

FIG 6—DECAYED WOOD is removed with special tool to prepare pole butt for application of preservative

FIG 7—LARGE CHECKS show effect of not removing all rot before last treatment. Decay started in checks

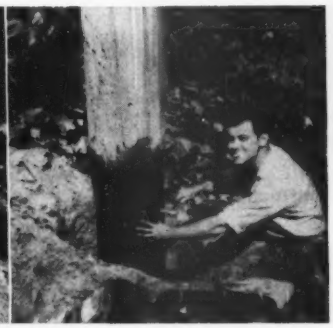


FIG 8—BANDAGE applied in 1950 was polyethylene plastic. Roofing paper was used in previous treatment

Some decayed poles have evidence of infection being started by season cracks extending to the groundline. Decay was directly back of the incised treatment, in some cases extending several inches into the pole.

It is realized that the number of poles checked with ½ in. depth of incising is too small to get a trend. In 1951 it is planned to survey approximately 5,000 poles set 1928 to 1937, inclusive, to obtain data on conditions at the groundline. With more extensive use of machines for digging holes and changes in ground elevation after the poles have been set, the 3-ft incisings have not given proper protection. It has been found that a large number of poles were set too deep. On others, where the elevation has changed, the original incising no longer provides the proper protection.

New Specification . . . Based on a study of this problem, a revised specification includes an extra 3-ft of incising. This provides incising 3-ft above and 3-ft below the groundline.

With treatment and re-treatment of the poles at the groundline, the good wood could be retained in this area as long as desired. However, the aboveground section of poles set on this system prior to 1941 are untreated and subject to decay. There are approximately 300,000 of these.

In 1946 some 40 and 45-ft Western red cedar poles that had been in service from 15 to 18 yr were sprayed with 5% pentachlorophenol in petroleum solution. On 540 of these poles the average retention was 4.3 gal of solution per pole. Tests on the depth of penetration have been made each year since the treatment began. Results show full sapwood and in some cases ¼ in. to ½ in. of heartwood fully protected.

Spraying of poles has been limited to the open country. This limitation is necessary because experience has shown that the mist from the spray head is frequently carried to nearby vegetation during windy weather. However, equipment is now being developed by the company which may be used to spray standing poles in congested areas. (See also "Preservative Applied to 60-ft Standing Poles for $15 Each", page 122, "Electrical World", March 26, 1951.)

The lives of poles set prior to the year 1941 could be extended through the application of proper preservative treatment. It is estimated that a single spraying, one ground-line treatment, and one re-treatment at a cost of approximately $1.15 per pole per year would extend a pole's life almost indefinitely. This treating procedure need be performed only once each 16-year period.

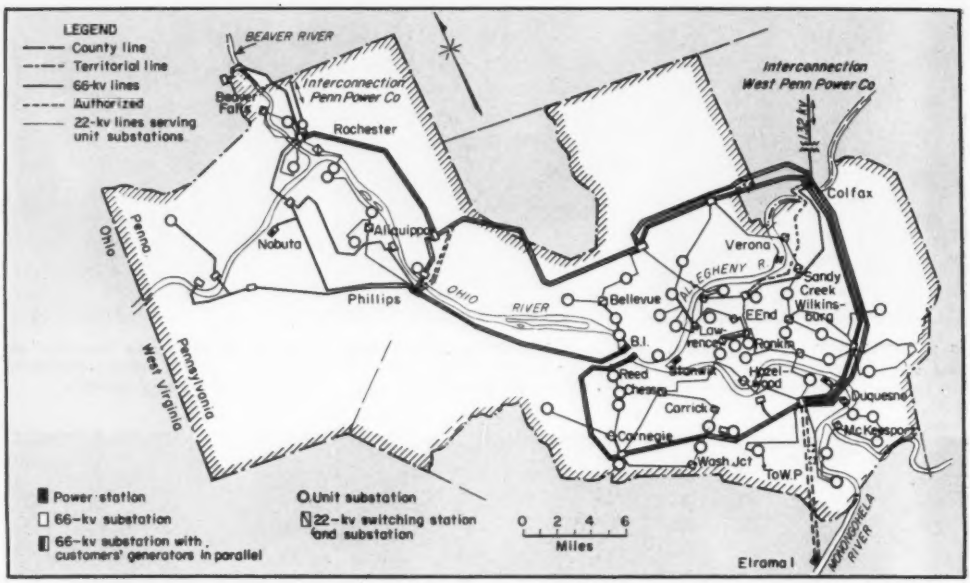


FIG 1—UNIT SUBSTATIONS and major elements of transmission systems of Duquesne Light Co. Note the system of 22-kv lines serving the more than 40 unit substations in the area. These substations helped meet distribution growth

Economical Distribution System Growth Solved With Unit Substations

Flexibility of unit applications for step by step development as load grows is a major factor in their application. Economics, service reliability and system convenience are other factors

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Electrical Engineering Department
Duquesne Light Co, Pittsburgh, Pa.

ON the Duquesne Light Co system in the Pittsburgh area there have been 38 unit substation installations, totaling 82,750 kva in the years 1947 to 1950 inclusive. Plans call for 37 units totaling 73,500 kva in the next three years.

Unit substations have been found especially adaptable to suburban districts. The 2,000-kva size is best suited to meet load and service requirements in these districts. For the higher load density in urban sections, the 3,750-kva multiple-circuit units have been found practical, reliable and economical. They are especially adaptable for use on primary networks. A few 1,000-kva units are used in low load density areas.

System Components . . . The Duquesne system comprises four generating stations, a 66-kv double transmission ring, 66/22-kv substations, and a 22-kv network of loop feeders which supply the 4-kv distribution substations and large industrial customers. A group of 11-kv feeders supplies the downtown secondary network and a number of nearby distribution and customer substations. The system map in Fig 1 shows in outline form some of the major elements of the transmission system with special reference to 22-kv lines serving unit substations.

Urban sections, generally supplied by large substations, have required additional distribution facilities due to load growth. Relatively long feeders from the larger substations have been supplying remote residential areas. In some cases, long branches extended into suburban and rural areas. Frequently induction regulators were cutting out during peak load periods, thereby indicating load growth and feeder length beyond the capability of station regulators. Except in a few cases, new two-bank substations could not be used economically to solve these problems.

The application of unit substations not only provided adequate service to outlying areas but also released capacity for load growth in the areas close to the larger substations. This proved to be an effective means of serving growing loads with maximum use of existing facilities as well as placing substation capacity at whatever load centers might be selected.

If earlier practices had been followed, the installation of larger two-bank substations for these rapidly growing loads would have delayed overload relief and voltage improvements. Production line methods were applied not only at the factory but also to a considerable degree in unit substation design. Construction and design practices were standardized in many respects thereby providing substantial economies of material and manpower. In fact, substations of the earlier types would have been prohibitive in time, cost and manpower requirements and therefore were impractical to meet the load conditions of the post-war period.

NEAT APPEARANCE and minimum space requirements are important factors in the application of unit substations to meet the needs of an expanding distribution system

Distribution Economics . . . When a general study of the distribution system was authorized a committee from the planning, operating and engineering departments reviewed available types of equipment and systems. Major objectives, used as guides for this analysis, were: (1) Economical system investment; (2) operating economy and convenience; (3) reliable service. Findings in this study formed the basis for the program carried out on general application of unit substations.

Available sizes of unit type substations were studied and estimates were prepared to determine the most practical and economical choice. Fig 2 shows the relative cost per kva of installed units of various sizes. Each unit is equipped with automatic tap changing under load and a 4-kv air circuit breaker with relaying for overcurrent and reclosing all mounted in a single housing. The 750 kva to 2,000 kva are single-feeder units and the 3,750 kva is a two-feeder unit. The 2,000-kva unit at the knee of the curve is a natural economic choice although further economy is available by the selection of the 3,750-kva unit provided other factors such as load density, load growth and total load to be served determine the suitability of such an application.

To provide a comprehensive review of unit substation applications, and comparisons with other types of substations, system diagrams were drawn to scale for a 16-sq mi urban area of uniform load density in 4 steps of 1,000, 2,000, 3,000 and 4,000 kva per square mile. Typical diagrams were selected. With the use of these system diagrams, comparative cost estimates were prepared and plotted on charts for the respective systems. These estimates covered transmission, substation and distribution costs. Relative costs of radial systems using single and multiple unit substations are shown in Fig 3 and similar

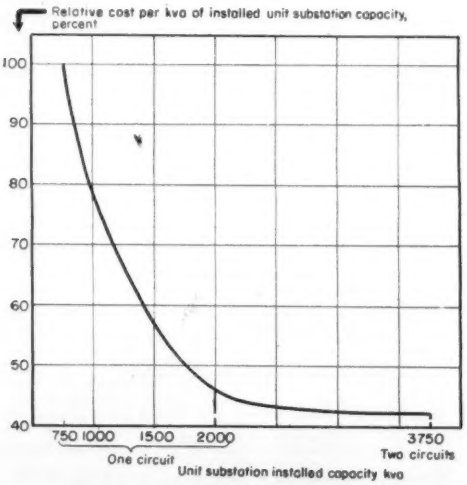


FIG 2—COST PER KVA by size of unit serving radial feeders helps in selection of most economical size units

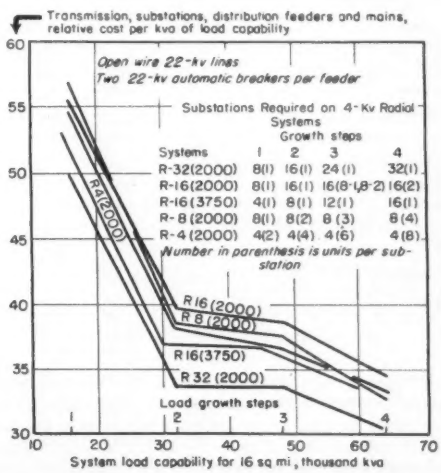


FIG 3—SYSTEM COSTS vs system load capability with different unit combinations aid in system selection

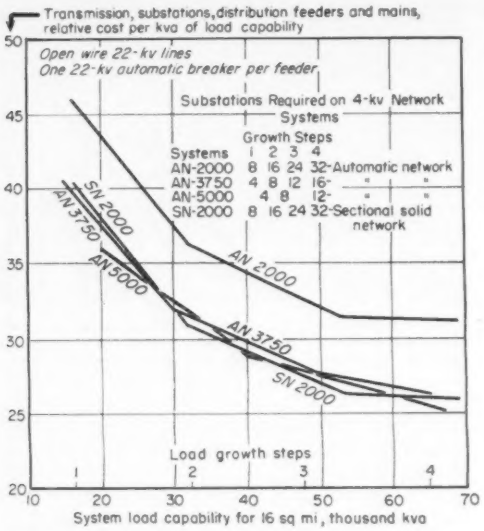

Transmission, substations, distribution feeders and mains, relative cost per kva of load capability
Open wire 22-kv lines
One 22-kv automatic breaker per feeder
Substations Required on 4-kv Network Systems
Growth Steps
Systems 1 2 3 4
AN-2000 8 16 24 32-Automatic network
AN-3750 4 8 12 16- " "
AN-5000 4 8 12- " "
SN-2000 8 16 24 32-Sectional solid network
SN 2000
AN 3750
AN 5000
AN 2000
AN 3750
SN 2000
Load growth steps
1
2
3
4
System load capability for 16 sq mi, thousand kva

FIG 4—NETWORK COSTS per kva for different types of systems decrease as system load capability increases

comparisons are made for network systems in Fig 4.

Single Units Used . . . The most economical radial system design was found to consist of 32 2,000-kva single unit substations installed in four steps of eight units each. This has been designated the R32-2,000 system and is

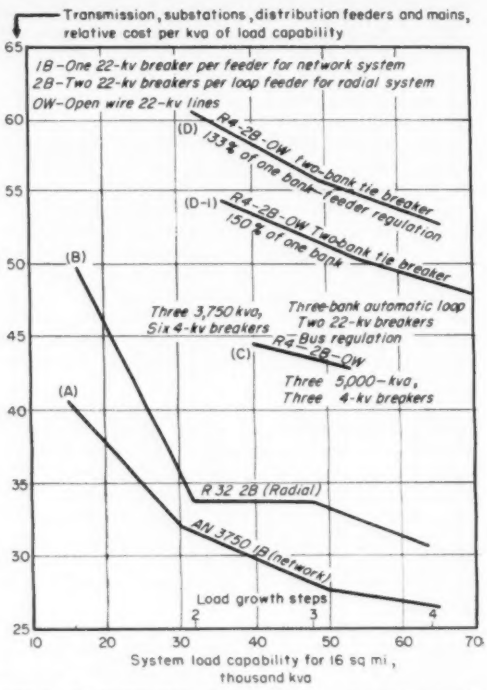

Transmission, substations, distribution feeders and mains, relative cost per kva of load capability
1B-One 22-kv breaker per feeder for network system
2B-Two 22-kv breakers per loop feeder for radial system
OW-Open wire 22-kv lines
(D) R4-2B-OW two-bank tie breaker 133% of one bank-feeder regulation
(D-1) R4-2B-OW Two-bank tie breaker 150% of one bank
(B) Three 3,750 kva, Six 4-kv breakers
Three-bank automatic loop Two 22-kv breakers R4-Bus regulation 2B-OW
(C) Three 5,000-kva, Three 4-kv breakers
(A)
R 32 2B (Radial)
AN 3750 1B (network)
Load growth steps
2
3
4
System load capability for 16 sq mi, thousand kva

FIG 5—COST PER KVA of load capability of radial, network, tie-breaker and automatic loop systems

TABLE I—Unit Substations Installed or Planned Duquesne Light Co System

Year	Number Installed	Capacity, Kva	Type
1947	2	2,000	ASR-SC
	1	2,000	ASR
Total	**3**	**6,000**	
1948	6	2,000	ASR-SC
	3	2,000	ASR
	1	2,000	SC
	1	2,000	
Total	**11**	**22,000**	
1949	3	2,000	ASR-SC
	2	2,000	SC
	2	2,000	ES
	1	2,000	
	1	2,000	ES(11/4-Kv)
	1	1,000	ES
	4	3,750	N-SC
Total	**14**	**34,000**	
1950	**2**	2,000	ES
	1	3,750	ES
	1	2,000	66/4-kv
	4	2,000	
	1	2,000	SC
	1	1,000	
Total	**10**	**20,750**	
Proposed For 1951-1952-1953	34	1,000	
	31	2,000	
	2	3,750	
Total	**37**	**73,500**	

ASR—Automatic 22-kv service restoration
ES —Enclosed 22-kv switching
N —Primary network units
SC —Supervisory connection and telephone

TABLE II—Unit Substation and Circuit Interruption Record

	1947	1948	1949	1950 (7 Mo)
Unit substations in service	3	14	28	34
Interruptions and cause				
Transmission[a]	0	12(1)[1]	41(6)	23(3)
Operation[b]	0	7(2)	10(4)	5
Substation[c]	0	2(1)[2]	0	1[3]
Total	**0**	**21**	**51**	**29**
Interruptions in excess of 2 min.	0	4	10	3
Interruptions (circuits only)				
Total	**0**	**58**	**129**	**125**
Interruptions in excess of 2 min.	0	3	6	17
Summary of Interruptions				
Total	**1**	**79**	**180**	**154**
Interruptions in excess of 2 min.	0	7	16	20

Operating Experience Data

Number of unit substation years' of service	45.5
Average number of outages per unit per year	0.37
Average outage time per unit per year	13.1 min
Percent of time each unit interrupted to date	0.0025
Percent of time allowable for customer outage, Duquesne Light Co Standard	0.0114
Average outage time for partial circuit interruptions	13.9 min
Average number of outages for partial circuit interruptions	0.1

[a]Transmission . . . . . Broken insulators, trees, defective lighting arresters, broken wire, etc.
[b]Operation . . . . . Emergency switching, operating errors, vandalism, etc.
[c]Substation . . . . . Equipment failure, bushings, circuit breaker, current transformer, potential transformer, etc.
[1]Figures in parentheses indicate the number of these outages in excess of 2 min
[2]High-tension fuse link blown
[3]Bushing failure

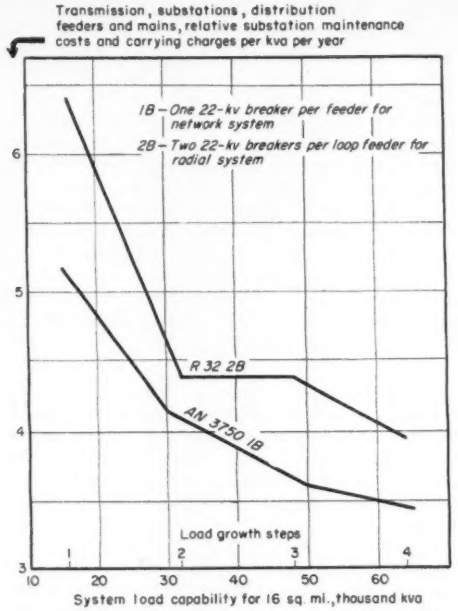


FIG 6—OVERHEAD COSTS (annual substation maintenance and carrying charges) are compared for two systems

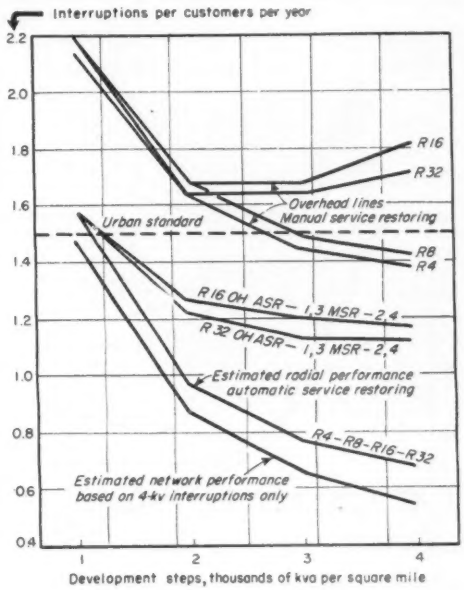


FIG 7—SERVICE CONTINUITY with different types of systems generally decreases with load growth

referred to in the curves. The most economical network system consists of 16 3,750-kva units with four installed in each step and has been designated the AN-3,750 or automatic network system using 3,750-kva multiple circuit units. In the next step of the analysis, relative costs of the lowest cost radial and network systems utilizing unit substations are also compared with systems utilizing two-bank and three-bank substations, as indicated in Fig 5. This review of relative costs demonstrates the economy of the primary network system.

Curves A, B, C, D and D-1 in Fig 5 provide basic comparisons for the various types of 4-kv distribution systems. The following items provide the reasons for the difference in system costs:

1. In curve D the high cost elements of a system utilizing two-bank tie-breaker substations are buildings, 22-kv breakers, induction regulators, 4-kv oil breakers, auxiliary 4-kv bus and fairly long, partially underground 4-kv feeders.

2. In curve C the buildings, regulators, and 4-kv oil breakers are superseded by outdoor equipment, bus regulation with tap changing under load, and air-break 4-kv breakers.

3. In curve B the 22-kv oil breakers have also been replaced with air-break 22-kv switches using either manual or automatic service restoration to meet service continuity requirements. The 4-kv feeders have been eliminated by locating the unit substations at load centers of circuit areas; no spare transformers are at respective substation sites.

4. In curve A, which represents the primary network, further economy and simplification is available by reducing the 22-kv transmission connections for each unit to a single radial or single tap arrangement, and by the use of more economical size units.

Fig 6 shows the results of a comparative study of annual costs for the R-32-2,000 and the AN-3,750 systems. This comparison verifies the economic advantage of primary networks previously shown in Fig 5 on the basis of capital investment per kva of load capability of these two systems.

Reliability ratings and comparisons were developed in a separate report and are summarized in Fig 7 and 8. The charts illustrate the reasons for including 22-kv automatic service restoration in some steps of the radial systems in order to meet Duquesne standards of service continuity. The standards for urban service specify not more than 1½ interruptions per customer per year and not more than 60 min of total outage time per customer per year. System design is provided accordingly, with calculated performance determined by means of system operating and experience data. It should be noted however that interruptions of less than 2 min are not counted in the development of performance data. The allowable interruptions for rural service are three and total outage time is 120 min.

Primary Networks . . . There are three 4-kv primary networks having seven substation units now in operation on the Duquesne system. Anticipated advantages of economy, service reliability, operating convenience, simplified transmission connections and improved voltage regulation have been realized in primary network operation. Primary network systems, however, are best suited for areas where

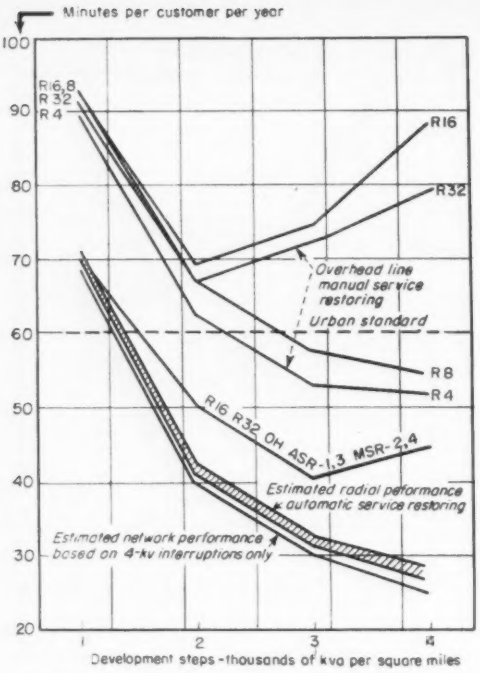


FIG 8—OUTAGE TIME in minutes per customer per year is shown for various systems analyzed by Duquesne Light

load growth is rapid and there is uniform load density.

Cost of a 3,750-kva network unit installed complete is approximately 85% of two 2,000-kva units installed for radial service. In addition to the 15% saving on units there is an additional 10% as a result of the single transmission connection.

Design Features . . . The 1,000 and 2,000-kva unit substations are single-circuit and are used generally for 4-kv radial duty. The 3,750-kva unit substations are multiple circuit and are used for 4-kv network duty, except in cases where temporary radial service is required. When the load justifies additional units, the 4-kva network connections are completed.

Single-circuit substations are connected on the supply side either into sectionalized loops or served with a tap from each of two high tension lines. When fed overhead, horn-gap disconnecting switches are used on the high tension side, either for manual operation or with any of several 22-kv load restoration schemes. Single circuit substations are purchased so that 4-kv connections can be made either overhead or underground.

When early units were purchased, confined arc interrupter switches were not available and designs did not provide for enclosed lightning arresters, means of making connections to the portable substations, or suitable methods for enclosing high tension switching unless circuit breakers were provided. When 23-kv and 34.5-kv confined arc air-interrupter switches were made available, an enclosure was designed for the high tension equipment incorporating these switches. It was originally intended that the totally-enclosed substation would be used only in those areas where 22-kv lines were either aerial cable or underground cable. However, it was found that the totally enclosed feature permitted satisfactory and safe installations on small sites and they were free from various hazards and possible danger to the public. With few, if any, exceptions, the totally enclosed job will probably be used in all future installations.

Use of a portable substation for maintenance or breakdown service made it necessary to develop means integral with the unit substation equipment for plugging in 22-kv and 4-kv insulated cable connections prior to taking the unit out of service. All unit substations have automatic tap changing under load and single-circuit units are compensated for feeder regulation.

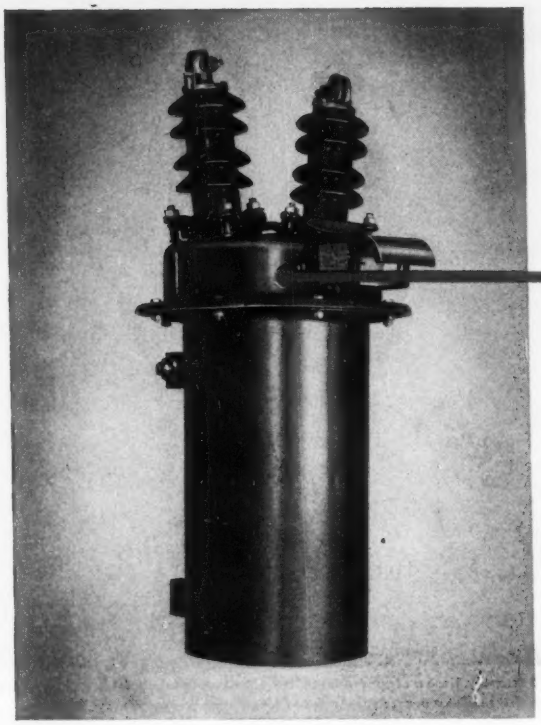
Selection of Sites . . . Selection of sites for unit substations is preceded by load studies to determine the most desirable locations for necessary overload relief and voltage improvement. Other factors considered are future load growth, special operating requirements, the most efficient use of existing system facilities, and allowance for geographical problems.

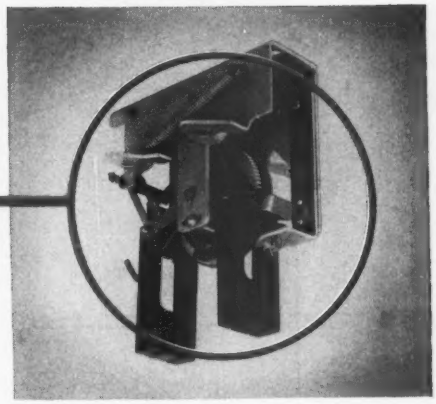
Preferred sites are not always available at a reasonable price and it is not unusual therefore that extended negotiations are necessary to reach agreement and to complete a purchase. Acceptable alternate locations however may appear as a result of further study and negotiations.

Small plots of ground hardly usable for other purposes have been found practical and acceptable, especially in the case of the totally-enclosed equipment. In some cases, company-owned lots or other tracts previously purchased for transmission right-of-way proved satisfactory for substation sites. Customers' substations in some cases are capable of accommodating unit substations. Development of the totally-enclosed unit substation has made it possible to use sites that would never have been considered when this program began.

Operating Experience . . . A review of operating results provides the best method for determining the successful use of unit substation equipment. Automatic tap changing under load for voltage regulation has been generally satisfactory. The refinements of single-phase induction regulators are not available however in unit-type equipment. Since the tap changers are controlled from only one phase, it is necessary to maintain a close balance of load between phases. The unbalance should not exceed 10% Feeders over a half-mile in length have been found difficult to regulate. These factors will become critical when loading the units to full thermal capability. These conditions emphasize the need for placing unit substations at load centers of circuit areas.

A study of interruptions for circuits supplied by unit substations provides a means for evaluating reliability on a continuity basis. More experience is needed however, to determine whether units without automatic service restoration on 22-kv connections actually meet the Duquesne standards of service. The interruption record for the unit substations is given in Table II.





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853-52

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All control elements are individually pre-tested before assembly. Here a composite test of the assembled control panel is being made. A final check of the operation of the completely assembled regulator assures proper co-ordination of all components.

NOW—CLASS 1 ACCURACY

ASA Standard C57.15-1949 defines three classes of accuracy for controls:

Class 1: not over ± 1% over-all error (99% accurate)

Class 2: not over ± 2% over-all error

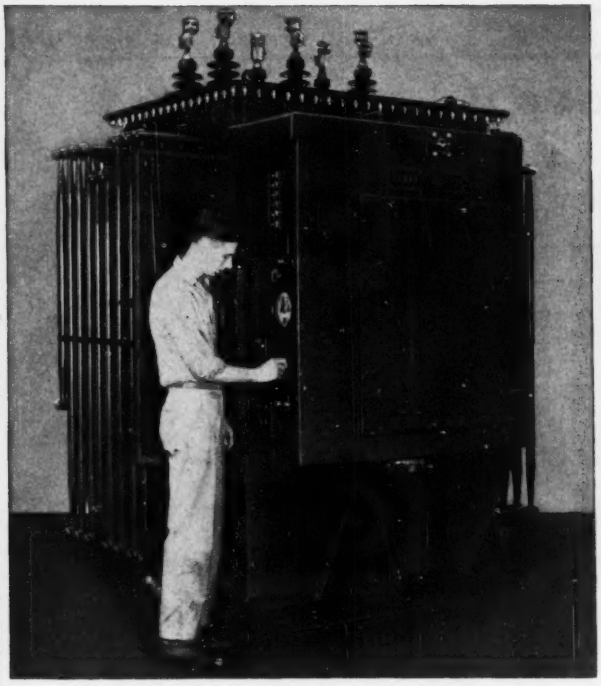
Class 5: not over ± 5% over-all error

This Standard recognizes errors arising from changes in temperature, frequency, ratio, regulator position, and load and their combined effects on the accuracy of:

1. Potential supply
2. Voltage regulating relay and associated ballast
3. Current transformers
4. Line drop compensator—resistance and reactance elements.

The maximum plus error and the maximum minus error must be determined in accordance with ASA Test Code C57.25. The largest total error, *either plus or minus*, determines the accuracy class of the regulator control.

The assembly of the voltage regulating relay, the "brain" of the regulator, requires skilled craftsmanship.



General Electric's three-phase 32-step Type MLT regulators are available in standard ratings for circuits up to 25,000 kva and 69,000 volts.

General Electric's Type IRS induction voltage regulators provide the finest regulation obtainable for heavily loaded, urban feeders.

IN G-E REGULATORS —AT NO EXTRA COST

This means better utilization of your feeders because they can now carry heavier loads for greater distances.

With ASA Class 1 accuracy controls on your regulators, more drop can be allowed in a regulated feeder without *at any time* exceeding established voltage limits.

These highly accurate controls meet ASA Standards for Class I devices, which call for at least 99% accuracy regardless of operating changes in temperature, frequency or load. And—they're now *standard equipment* on all General Electric station-type feeder voltage regulators. This includes induction-types IRS and IRT, as well as the step-type MLT 32.

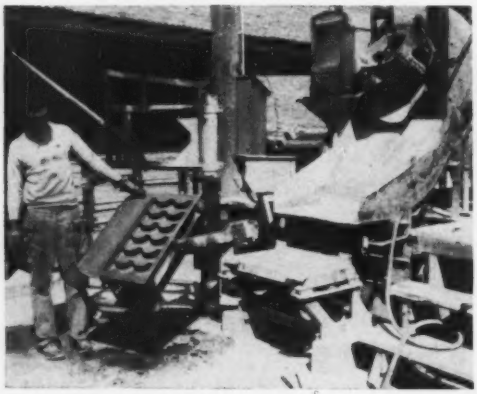
This important new development stems from several years of research and engineering. Laboratory techniques have been adapted to factory procedures. The production of these controls demands the same brand of "know-how" that has made General Electric the leader in the field of voltage regulation for over fifty years.

For further information on how Class 1 accuracy can increase feeder capacity for you, see your G-E representative. *General Electric Co., Schenectady, N. Y.*

404-75

GENERAL ELECTRIC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN



VIBRATING TABLE, rotary concrete mixer (right) and means for swinging and inverting mold forms (center) have increased production and cut cost of concrete spacers by two-thirds

SHAPES AND SIZES of concrete spacers in a wide variety are available from interchangeable wooden molds designed by engineers of the Los Angeles Dept of Water and Power

Vibrating Table Cuts Concrete Spacer Costs

JOHN R. KELLEY

Engineer
Underground Distribution
Los Angeles Dept of Water and Power
Los Angeles, Calif.

Labor costs of producing concrete spacers have been cut from 12¢ to 4¢ per unit by a vibrating table used by Los Angeles Dept of Water and Power. Output has been stepped up from 200 spacers per day to a maximum of 2,800 per day; breakage has been drastically reduced. About 20,000 spacers in assorted sizes are used annually by the department to support fiber conduits for pouring of concrete casings during underground construction.

Spacers formerly were made of concrete mixed in a mortar box and tamped in a wooden mold holding two spacers. Despite greasing of the mold surface, spacers often stuck and breakage during their removal was not uncommon.

The cost-saving machine is essentially a vibrating table upon which the mold rests while the concrete is poured from a rotary concrete mixer. Vibration of the table accomplishes the necessary tamping, after which the mold is inverted and swung into position over a wooden pallet. Spacers are then knocked out. Completed spacers on pallets are stacked in layers.

The mix ratio of 1 part cement, 3.5 parts sand, and 3.3 parts pea gravel is stiff enough so that weight of upper layers of spacers causes no noticeable deformation of the lower ones. Because spacers harden outside the mold, there is no problem of breakage during their removal from the forms.

Portable Test Outfit For Load and Voltage Surveys

H. T. FESSLER
W. J. KOBEL

Meter Dept, Central Division
The Ohio Power Co
Canton, Ohio

Here's how a combination of four graphic meters and switches may be assembled in a convenient weatherproof portable case, and provide a safe, convenient method of switching such devices for load surveys. With this device, load and voltage tests of the primary distribution system are recorded during selected periods each year to check the loading of various substations and feeders on the Central Division of The Ohio Power Co.

The test outfit illustrated has six advantages: (1) Compactness; (2) reasonable weight, and good balance for two men to carry; (3) convenience and safety in switching from one current range to another; (4) utilization of standard stock items which are easy to assemble; (5) elimination of auxiliary equipment such as autotransform-

This cutout is liberally designed—has high dielectric strength, uses silver-plated contacts, provides full-range interruption of fault currents, and is conservatively rated as to interrupting capacity. All live parts are completely enclosed for maximum safety.

4 CUTOUTS IN ONE

by simply changing doors

AND THAT'S ONLY HALF THE STORY! By stocking only three interchangeable doors which fit both 5.2 and 7.8 kv, 50-ampere housings, you get the 4 operating functions illustrated below—a total of eight essential cutout combinations! Available also in 100-ampere ratings, this unique flexibility reduces inventory and simplifies stocks.

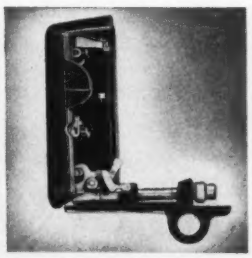
INDICATING OR DROPOUT WITH A TWIST OF THE WRIST! A small wire yoke, easily inserted or removed, determines whether the fuseholder door "kicks out" at the bottom for visual indication, or drops open—either way giving positive evidence of a blown fuse.

RECLOSING DOOR AVOIDS UNNECESSARY SERVICE TRIP! The two-element reclosing door restores service within one second after a temporary fault blows the first fuse link. By avoiding an extra service trip, the two-shot cutout pays for itself the first time it operates!

FLEXIBLE DISCONNECT BLADE CAN'T GET LOST! It's fastened to the door—can't be misplaced. This disconnect blade doubles the continuous current rating of the cutout. When the blade is disconnected and the door closed, the flexible cable extends downward to indicate that the circuit is open.

Only G.E. offers you this flexibility of cutout applications. For complete information contact your G-E sales representative, or write for Bulletin GEA-3448. *General Electric Co., Schenectady 5, New York.*

Indicating


Drop-out

Reclosing

Disconnect

GENERAL ELECTRIC

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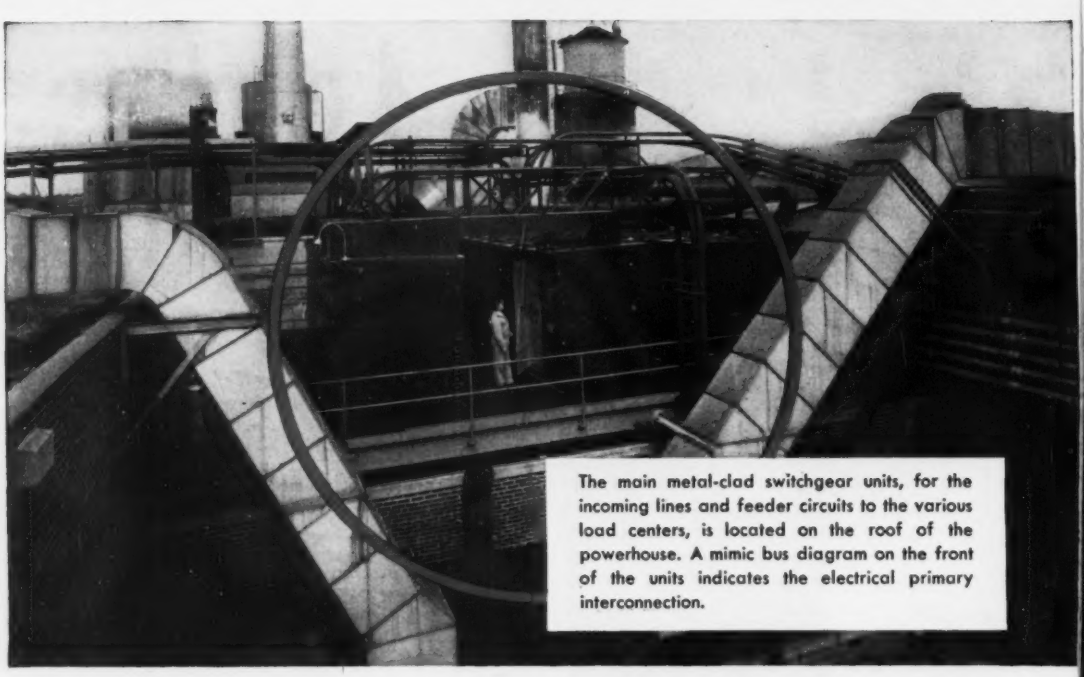


The main metal-clad switchgear units, for the incoming lines and feeder circuits to the various load centers, is located on the roof of the powerhouse. A mimic bus diagram on the front of the units indicates the electrical primary interconnection.

PUTS SWITCHGEAR ON ROOF

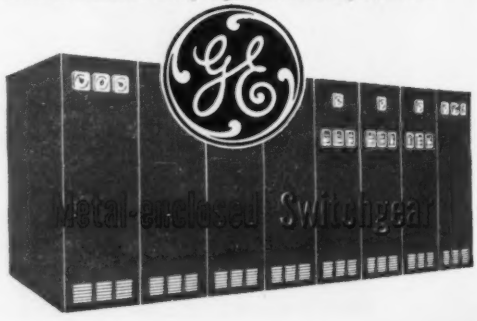
saves 10,000 sq. ft. of floor space

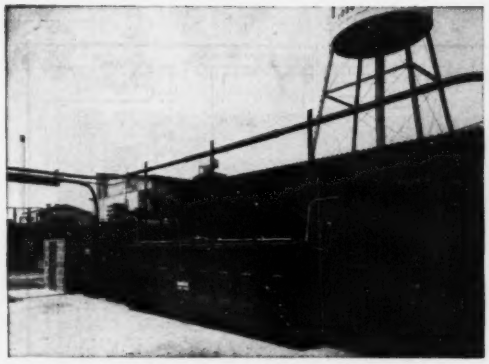
Indoor space limited—installation made with almost no interruption of production —Maintenance will be greatly simplified.

When Scott Paper Company, of Chester, Penna., completely revamped its electrical system to take care of expanded plant output, it made one rather unusual decision. Because indoor space was limited, it put all its switchgear and load-center units on the roofs of the various buildings. The incoming utility power lines, at 13,200 volts, terminate in General Electric outdoor metal-clad switchgear on the roof of the powerhouse, and the 575-volt distribution system is fed through G-E metal-enclosed gear located on roofs of the individual buildings. Distribution between buildings is at 13,200 volts with step-down load-center units.

This type of installation has proved to have a number of advantages. In the case of Scott Paper, 10,000 square feet of badly needed floor space became available for paper making. The entire installation could be made during normal working hours, yet did not interfere with plant production. Likewise, routine inspection and maintenance can be done without entering the manufacturing areas. All breakers are of the easily-removable type that is so easy to maintain and inspect.

What's more, there's plenty of space for expansion. Provision has been made to double the capacity—by adding transformers and switchgear—when still more electric power is needed later. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

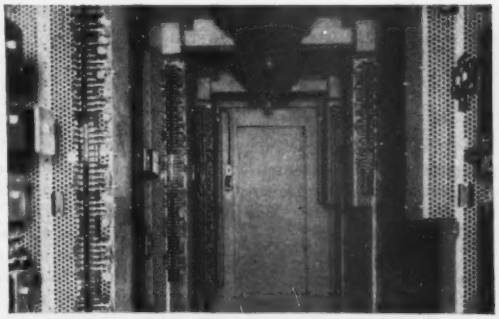


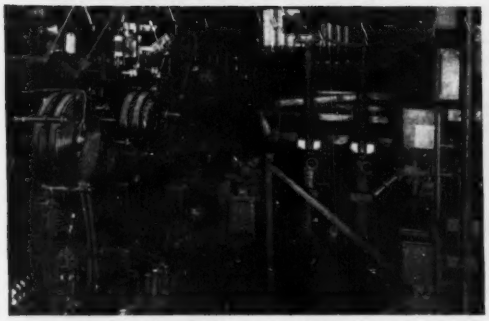


A double ended load-center unit feeding the large 2300-volt motors in one of the main buildings. Unit consists of two power transformers with air-interrupter disconnects, and metal-clad switchgear units for metering and for the four magne-blast air circuit breakers.

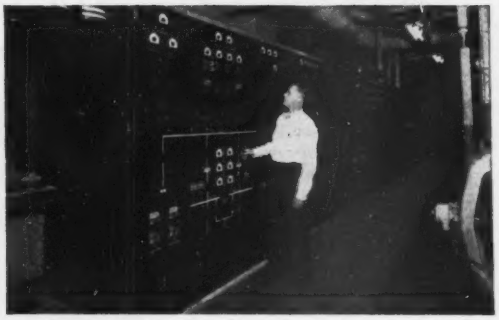
One of several single-ended load centers, which can be doubled in capacity later by adding a second transformer and low-voltage switchgear units. This particular unit uses metal-enclosed gear with draw-out air breakers to 575-volt feeders which serve the paper finishing units.

New switchboards simplify control — Increase safety





BEFORE Front and rear views of the old switchboard which handled all the plant's power at 575 volts. Open buses, breakers, knife-switches, and resistors were a definite hazard — and one bad short circuit or fire could have closed down the plant.



AFTER Main switchboard is now simply a control board. Incoming line and feeder circuits can all be closed from this one location. No power lines or high voltage is brought to this board at all — and there are no open buses or switches to form a hazard to personnel.

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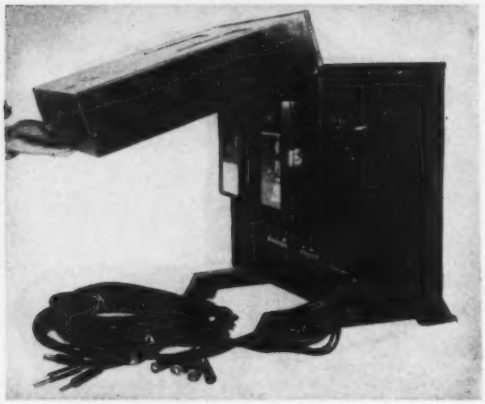
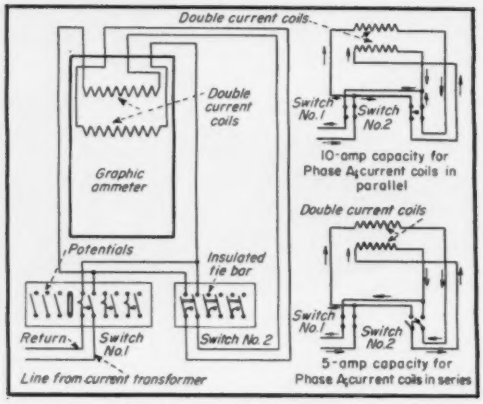
GENERAL ELECTRIC

Portable Test Outfit *(Continued)*



FOUR GRAPHIC METERS comprise test outfit for recording load and voltage on primary distribution transformer stations and feeders. This side view shows two boxes (each containing two meters) bolted back to back, ¼-in. between them



ONE GRAPHIC AMMETER with two current coils is diagrammed here. Both front and back covers have windows, but covers can be lifted off (see photo at left) to give access to switches and meters. Raised cover at top helps ventilation

ers, thus avoiding one source of error; and (6) relatively low cost for material and labor, which was approximately $43 exclusive of meters, based on 1947 prices.

Three double-range graphic ammeters with 5 and 10-amp scales, and a graphic voltmeter are used. They eliminate weight and space required by autotransformers.

Two instruments are mounted in each of two outdoor meter boxes. The boxes are bolted back to back with ¼-in. spacers between them to allow air circulation and are supported on 4-in. wooden feet to prevent corrosion. Ventilation removes heat generated by the voltmeter resistor.

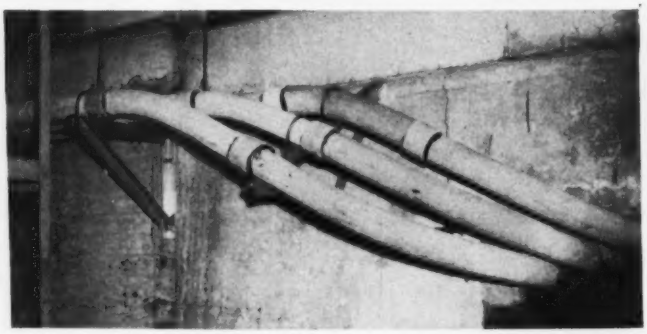
Color-coded wire is used between the switches and meters. Interior interconnections between boxes are through a 1-in. insulating bushing. Test cables emerge from one box near the bottom through a 2-in. knockout. The knockout is equipped with a rain-shed made from the service-head of an old dry-type outdoor potential transformer. Each pair of test cables is identified by narrow bands of cord which are wrapped on the ends and shellacked.

Some modifications of standard 3-phase, 4-wire test switches were made as illustrated to provide necessary switching facilities. The modifications were required because of slow deliveries on directly applicable test switches at the time this outfit was developed.

Brackets Route Generator Cable Cheaply and Simply

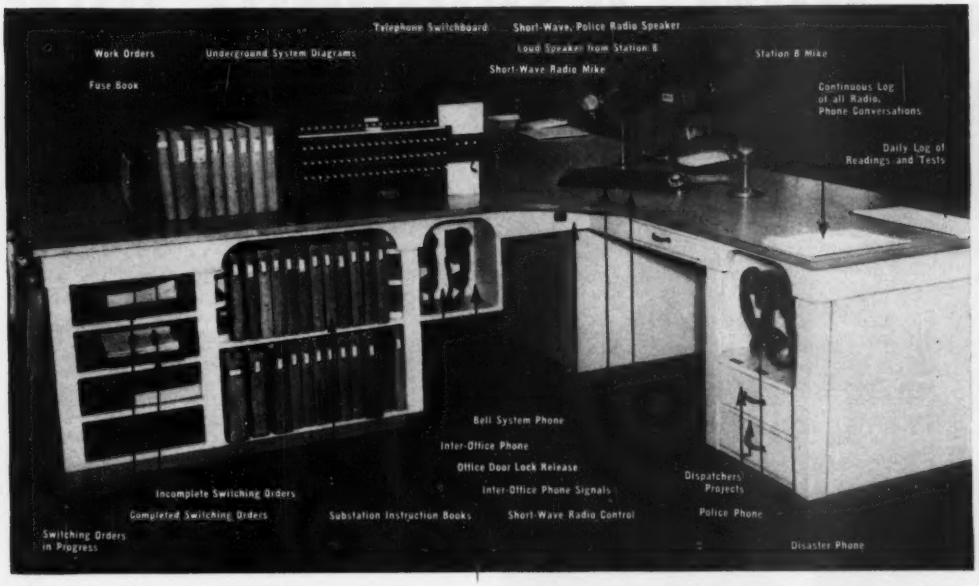
Energy generated by a gas turbine unit at Central Maine Power's Farmingdale station is brought out of the plant by three 1,000-Mcm, 4,160-v cables economically supported on the building wall. Construction used by the company in changing direction and level of the cable route avoided underground work, provided ease of erection, maximum accessibility, and took up little space as compared to the commonly-used multi-lateral steel framing structures.

The transformers tying the unit into the transmission system are mounted well above the adjacent Kennebec River for flood protection. This necessitates change of direction and of level in the cable route between the switchgear inside the plant and the step-up substation. This is accomplished at low cost by fastening only two 3-in. angle-iron brackets to the building wall with ⅝-in. anchor bolts. Cables are secured to the brackets by ½-in. rings. The cables are lead-covered, V. C. insulated, in Transite ducts.



ONLY TWO BRACKETS are needed to change the direction and level of this three-phase, 1,000-Mcm lead-out from the power plant switchgear to step-up substation

Custom-Made Dispatching Desk Ups Efficiency 50%



HALF AGAIN AS MANY OPERATIONS can be handled at this T-shaped dispatching desk designed and built by San Diego Gas and Electric Co. C. J. Nevitt, supt of electrical transmission and distribution, reports that two men on opposite sides of the common counter handle with ease an average of 617 switching orders each week. It features centralized radio and telephone facilities along with system diagrams, switching instructions, and work orders needed for normal and emergency operation. Desks were built in company shops, using pine and a special jaspe linoleum for the top, for $750 each

Mobile Radios Improve Service, Reduce Operating Expenses

J. W. COMPTON
Superintendent of Distribution
Bluefield Division
Appalachian Electric Power Co
Bluefield, W. Va.

Worth of mobile FM radio in the Bluefield Division of Appalachian Electric Power Co has been proved by four years' experience.

Consider one of the four operating districts in the Bluefield Division. It covers 2,500 sq miles, has 103 miles of transmission line (88-33 kv) and 2,700 mi of distribution, and includes approximately 38,000 residential, rural, and commercial customers.

Equipment for the district: One main fixed transmitter rated at 60 w is at 3,600-ft elevation; 28 mobile units rated 30 w, plus one spare and one 60-w mobile set, installed in two passenger cars and 27 line and service trucks; on all trucks a 60-amp generator provides high charging rate at low engine speed; two portable units with 1.5-mile transmitting radius but greater receiving range for communication between vehicles and foot patrolmen.

Estimated annual savings for line work, answering trouble calls, running services, giving service locations, plus fewer miles traveled, fewer telephone calls and the like, are estimated at $18,784 gross or $13,462 net.

Investment for the first 26 mobile units (30 w) and fixed radio station (60 w) was about $21,000 or $780 average per unit.

Maintenance cost of the equipment is given at right, based on records for the year May 1, 1949-1950. Judging from this short experience, the mobile sets should give 10 years' service at costs shown in the table.

Adapted from data presented at Southeastern Electric Exchange Conference, Atlanta, Ga.

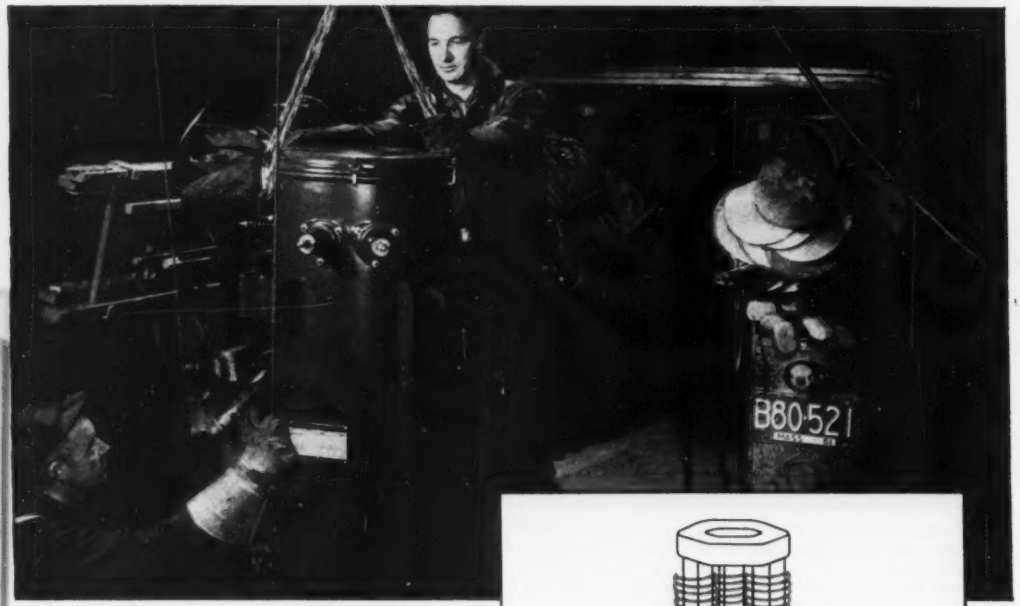
How Age Affects Maintenance

	1 year old	2 years old	3 years old
Parts	$ 3.75	$ 5.04	$10.26
Labor & expense	25.00	28.60	67.00
Yearly Expense	$28.75	$33.64	$77.76

Estimated Annual Expense and Savings

Depreciation	$ 78
Parts Replacement	15
Labor & Expense	70
Total Expense per Set per Year	$163
Total Expense for 30 Sets per Year	$4,890
Cost of Leased Telephone Circuit	432
Total Cost per Year	$5,322
Savings per Year	$18,784
Total Cost per Year	5,322
Annual Net Savings	$13,462

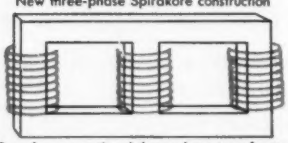
Now-a radically new



New three-phase Spirakore distribution transformers are easier to handle. The 45-kva unit is 400 pounds lighter than conventional designs, and takes 21% less platform space. Its height is 17 inches less than the vertical or "stacker" type.

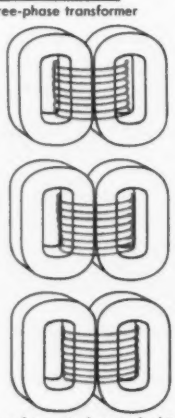
This is a typical core of General Electric's new Spirakore three-phase distribution transformer. The core steel is "corosil"—cold-rolled silicon strip with the grain structure of the steel oriented with the flux path.

New three-phase Spirakore construction



Core for conventional three-phase transformer

The line sketches above and to the right show the relative proportions of the Spirakore core compared with the core used in the conventional horizontal three-phase transformer and with that used in the vertical or "stacker" type.



Core for vertical or stacked-type three-phase unit

SPIRAKORE* three-phase distribution transformer

Revolutionary General Electric design cuts weight 25% over conventional units

New transformer uses cold-rolled oriented steel in wound-core construction for the first time in a three-phase core. Improvements include smaller dimensions, easier handling, and lower exciting current. This transformer is suitable for *either* pole or floor mounting.

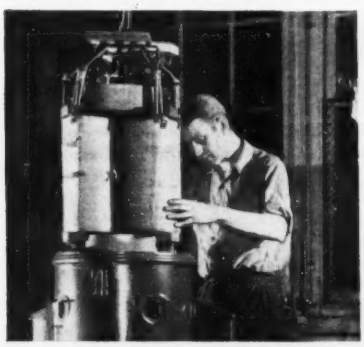
General Electric is now building three-phase distribution transformers up to 150-kva, 15,000 volts and below, with Spirakore construction. This is the result of intensive research—another advancement by the company that first introduced wound-core construction to distribution transformers in 1937.

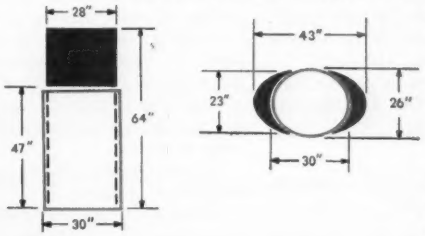
These new three-phase transformers have lighter weight, smaller dimensions and lower exciting current. All the other improvements that have characterized Spirakore are incorporated—high mechanical strength, excellent impulse strength, completely sealed tanks, and superior Melaglyp† paint that is 50% better in resistance to weathering and moisture absorption.

For full information on these transformers, contact your nearest G.E. Apparatus Sales Office, or write *General Electric Company, Schenectady 5, New York.*

* Reg. Trademark of General Electric Company.
† A new, greatly improved G-E paint made with melamine-modified Glyptal (registered trademark of the General Electric Company for alkyd resin).

Here the core-and-coils of a 30-kva Spirakore three-phase transformer are being lowered into the tank.





These two diagrams compare the height of the new three-phase transformer, in red, with that of a vertical or "stacker" three-phase unit, in black—and the floor area with that of a conventional or horizontal three-phase transformer. In both cases transformers are rated 45 kva.

THREE-PHASE SPIRAKORE TRANSFORMERS 9-150 KVA, 5000 VOLTS AND BELOW

	9 Kva	15 Kva	30 Kva	45 Kva	75 Kva	112½ Kva	150 Kva
Net Wt Inc. Liquid	390	510	900	1000	1400	2100	2450
Height	29	39	47	47	57	63	70
Floor Space	24x23	24x23	28x26	30x26	33x29	36x34	36x34
Liquid (gal)	16½	20	39	37	62	87	92

GENERAL ELECTRIC

402-107

Three Essentials of F-Lamp Renewals

Rated life, renewal rates, and group replacement are outlined for fluorescent lamps

RICHARD G. SLAUER, Manager, Applications Laboratory
Sylvania Electric Products Inc, Salem, Mass.

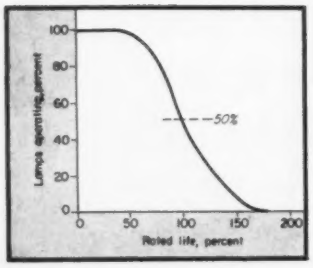


FIG 1—Mortality curve for lamps

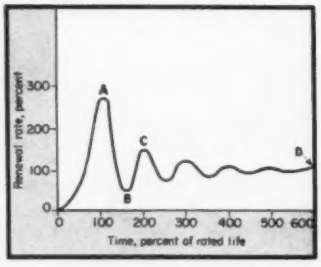


FIG 2—Renewal rate in relation to rated life. (A) This point is slightly beyond the maximum slope of the mortality curve since replacement lamps add to total burnouts. (B) Almost all original lamps have burned out; first replacement burn outs are beginning to be important. (C) Several fixtures already have all of their third lamps; most of them are mixtures of second and third. (D) Stabilized number of burnouts per day

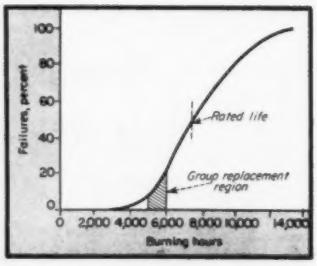


FIG 3—Lamp group replacement region

1. Rated Lamp Lives Are Averages

Automatic equipment and good quality control lead to average lamp lives very closely approximating published values. Individually, however, lamps will burn out in the pattern shown in Fig 1, assuming normal operating conditions. This is called a "mortality curve." Abnormal conditions (excessive current, frequent starting) tend to shift the curve but do not materially alter its basic shape.

2. Renewal Rates Vary Greatly Until the Installations Stabilize

Number of burnouts per day in a large installation can be calculated readily by the formula:

$$\text{Burnouts per day} = \frac{\text{No. of Lamps} \times \text{Operating Hr per Day}}{\text{Rated Life}}$$

But this only applies after the installation has been in operation at least five times rated life. Where preheat lamps rated at 7500 hr are used, it might take 10 or 15 years for the renewal rate to become stable. This principle is illustrated in Fig 2.

During the first months of any installation, almost no replacements are needed. The rate increases slowly until about a time equivalent to rated life is reached. Then burnouts of two or three times normal occur. Not only must compensation be made for the first period when burnouts were below normal, but the replacement lamps will also contribute a small percentage of early burnouts. Gradually the whole installation becomes a thorough mixture of lamps put in at different times. When this happens, average failures per day become quite uniform and can be calculated by the above formula.

3. Group Replacement Often Offers Possibilities of Saving

The term "group replacement" is self-explanatory. It specifies the replacement of lamps in large areas at the same time, rather than hit and miss as they burn out. This method discards lamps which still have useful burning hours, but the value thus "wasted" is balanced by a saving in labor costs or by the elimination of possible nuisance or inconvenience factors.

Fig 3 is Fig 1 replotted for Sylvania 40-w, T-12 preheat fluorescent lamps operated on a 3-hr cycle (curves for other lamps would be quite similar). Even inculding lamps damaged in shipment which do not show up prior to installation, the burnouts at 5000 hr are less than 7%. Replacement cost is low for these few lamps; in fact, if appearance is not a critical factor, the loss in light over a large area (7%) will not be particularly objectionable.

If then, at 5,000 hr, all lamps are replaced in one group, very substantial savings may be realized because:

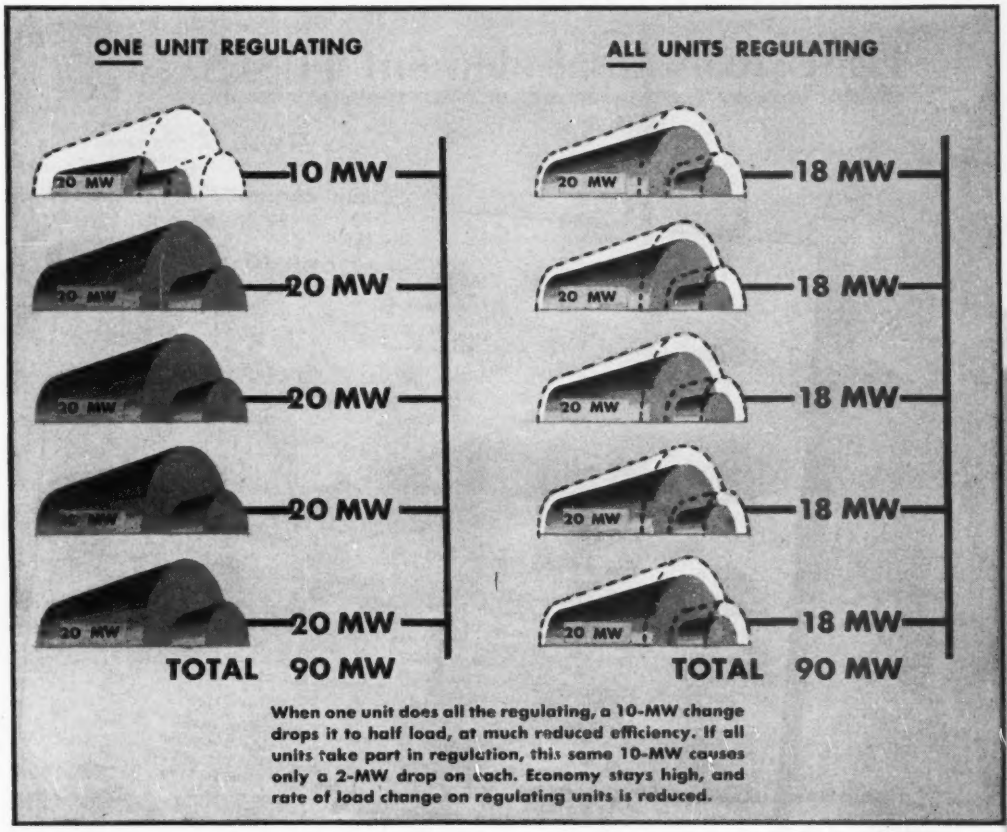
(a) The labor of replacing lamps in groups as against sporadic replacement may be reduced as much as 90% per lamp. This item must be checked in each individual case—few large installations save less than 75%.

(b) The lamp value thrown away is quite small—2,500/7,500 × average price—or about 30¢. This value is usually far less than replacement costs on an individual basis. In addition this end-of-life period represents the lamp at its lowest efficiency and poorest appearance (spots, end bands).

(c) It is far easier and cheaper to include cleaning as part of a lamp group replacement plan that to do the jobs separately. And replacement helps to draw attention to the value of planned cleaning.

(d) The few replacements made prior to the 5,000-hr period can be marked and re-used effectively. Some of them may have been operating only a few hundred hours.

How L&N Unit Load Control Cuts Effects of Load Changes



When one unit does all the regulating, a 10-MW change drops it to half load, at much reduced efficiency. If all units take part in regulation, this same 10-MW causes only a 2-MW drop on each. Economy stays high, and rate of load change on regulating units is reduced.

SPLIT up system load changes among as many generators as possible—and get smoother, better-scheduled loading on each unit. This trend in system control is a practical means of keeping load and generation balanced within a regulating area.

The bigger the system, and the larger its total load changes, the greater is the opportunity of using Unit Load Control to minimize the size and speed of variations felt by each unit. Ample flexibility is built into the control to allow the station operator to choose ratio of load distribution, maneuvering points, and high or low limits—as determined by the system's requirements of the moment.

If you're adding new units, plan now for tomorrow's control needs. Or if you're examining your present system with a view towards greater flexibility and closer automatic control of regulation, investigate the possibilities of applying Unit Load Control to present capacity. An L&N engineer will be glad to work with you on your problem, or to send a copy of our catalog. Write to Leeds & Northrup Company, 4938 Stenton Avenue, Philadelphia 44, Pa.

Jrl. Ad ND4-56-461(3)

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

"WE WERE LOSING 5 KILN MOTORS PER MONTH UNTIL WE CHANGED TO FUSETRON dual-element FUSES."

Malvin E. Adams.
Electrician

OZARK HARDWOOD COMPANY

PHONE 252

JOE B. MILLS, MANAGER

CLARKSVILLE, ARKANSAS
April 20, 1950

Bussmann Manufacturing Co.

St. Louis, Missouri

Dear Sir:

I have found a great savings in your Fuzetrons.

Two and one-half years ago I started changing my Dry Kiln motors to Fuzetron protection. Up until I changed completely I was loosing an average of 5 motors per month which was very expensive. I was having to fuse my motors too heavy to pick up the load, then if something went wrong the fuze were too heavy and held the motor on the line, therefore burning it up.

My Kiln motors are 1½ h.p. 5 amp. I fuse them with 5 amp fuzetron. The fuzetron will hold this starting load and when it picks up I still have motor protection if anything goes wrong the fuzetron will blow in time to keep the motor from burning up. I fuze my main pannell with 6 - 600 amp. fuzetron. I used to blow fuzes on this until I changed to fuzetron, therefore, taking care of the surging load.

I have approximately 800 h.p. I fuse almost all the plant on fuzetron. My trouble has been very light since changing to fuzetron for motor protection Fuzetron is tops with me.

Yours very truly,

Malvin E. Adams

Malvin E. Adams
Electrician

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

Fusetron DUAL ELEMENT Fuses

Give 10 Point Protection

- ★Protect against short circuits.
- Protect against needless blows caused by harmless overloads.
- Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
- Provide thermal protection — for panels and switches against damage from heating due to poor contact.
- Protect motors against burnout from overloading.
- Protect motors against burnout due to single phasing.
- Give DOUBLE burnout protection to large motors — without extra cost.
- Make protection of small motors simple and inexpensive.
- Protect against waste of space and money — permit use of proper size switches and panels.
- Protect coils, transformers and solenoids against burnout.

★ Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

What is the FUSETRON Dual-Element FUSE?

A fuse link combined with a thermal cut-out — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to same dimensions as ordinary fuses, FUSETRON Fuses fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

Fusetron is a trade mark of Bussmann Mfg. Co., Division of McGraw Electric Co.

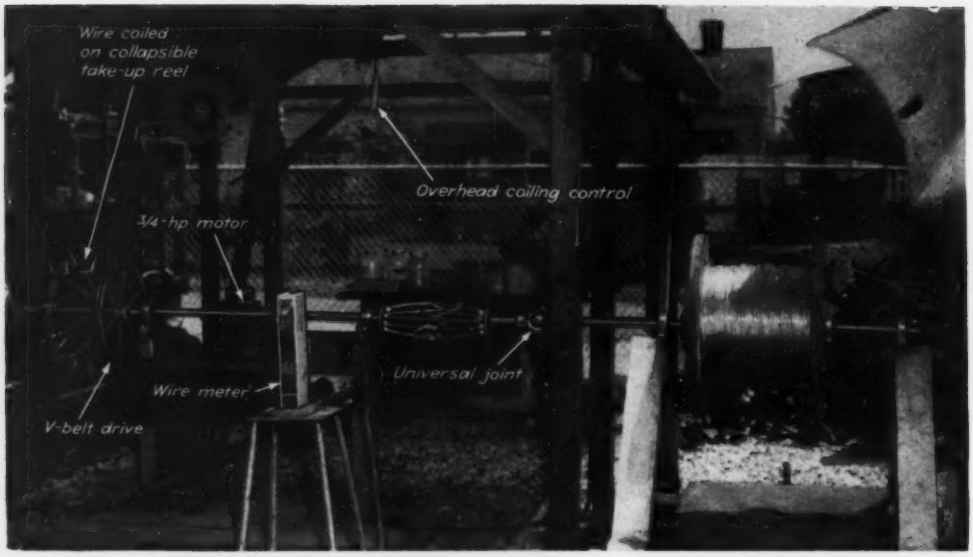
Don't risk losses in your plant!

One **lost** motor,
One **needless** shutdown,
One **destroyed** panel or switch,
One **burned out** solenoid —
May cost you more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

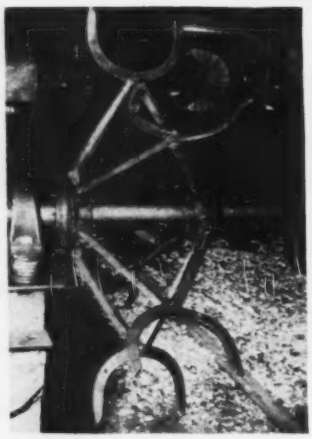
Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON Dual-Element FUSES.

Name_____
Title_____
Company_____
Address_____
City_____ State_____ 451

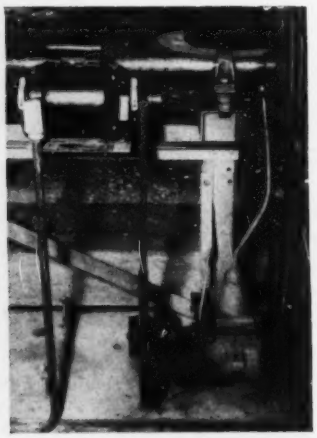


WIRE COILING SET-UP, with exception of the feeding turntable, which is saving Louisiana P&L $6,000 annually in new conductor costs. Wire is drawn off through the measuring device and moves directly to the collapsible reel



TAKE-UP REEL on which coil is formed is here shown in an extended position

COIL IS SECURED with a standard wire twister before reel is collapsed



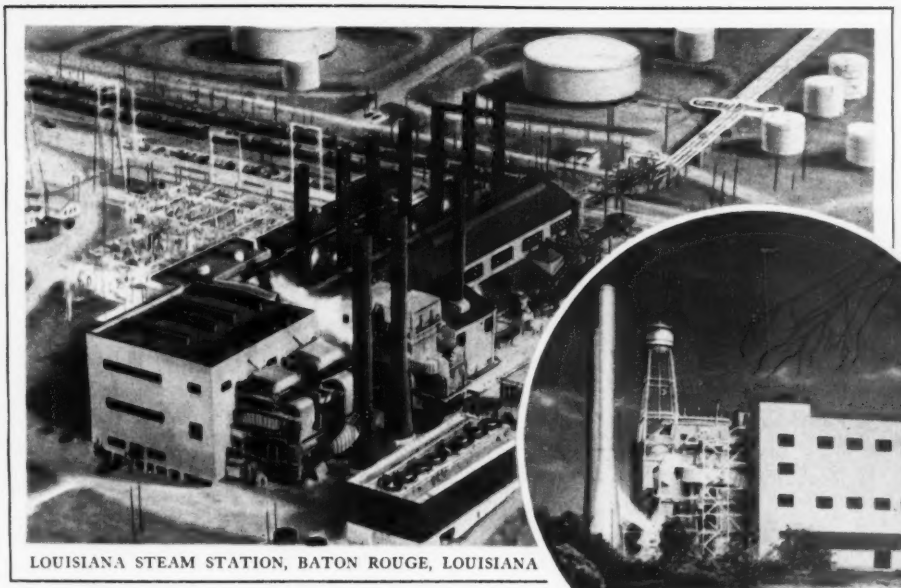
MOTOR AND TRANSMISSION permit three speeds for coiling machine

Annealing Hard Drawn Conductor Saves $6,000 Annually

Annealing hard drawn wire instead of selling it as salvage is saving Louisiana Power & Light Co in excess of $6,000 yearly . . . aside from helping out the copper conductor situation. The No. 6 hard drawn wire is rewound on the coiling machine setup shown above, and then annealed by a firm charging 3¢/lb. About 75,000 lb of soft drawn No. 6 is used yearly.

Tom Lingoni, storekeeper for the Algiers Div, perfected the winding device. Comprising the device are a ¾-hp electric motor, a Model A transmission, universal joints, turntable, and necessary shafts and reels.

Once the wire has been coiled, it is secured with short pieces of wire as above, reel is collapsed, and coil removed. Coiling operations can be controlled from an overhead cord. A universal joint in the shaft lends flexibility for winding the wire on conventional reels of various sizes.

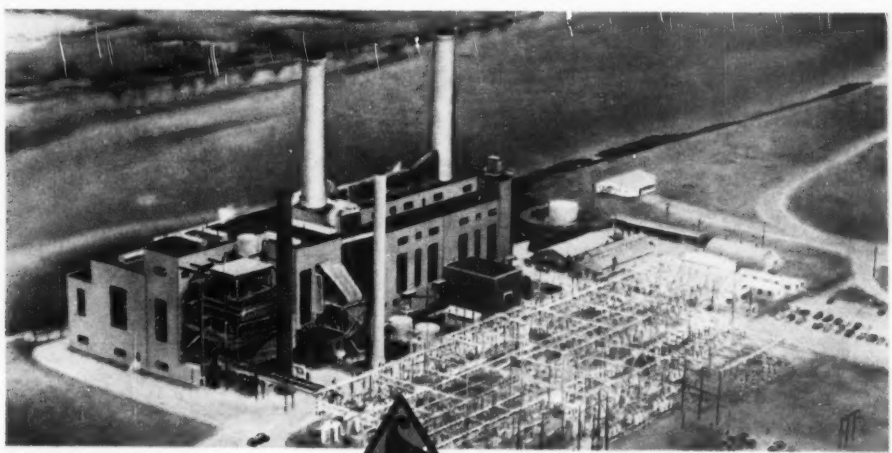


LOUISIANA STEAM STATION, BATON ROUGE, LOUISIANA

Magnet for Industry

RIVERSIDE STATION, LAKE CHARLES, LOUISIANA

Industry has been drawn to the Louisiana and East Texas area of Gulf States Utilities Company by a plentiful power supply. Recently completed additions and work in progress will bring the total generating capacity of the system to over 600,000 kw. With the exception of 35,000 kw partially installed at Riverside when it was acquired by Gulf States Utilities Company, all of this capacity has been designed and constructed by Stone & Webster Engineering Corporation.



NECHES STATION, BEAUMONT, TEXAS

STONE & WEBSTER ENGINEERING CORPORATION

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GUY GUARD

(the aluminum-coated wood guard that's flexible)

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No other type of guy guard is so easy to handle, so simple to install . . . none so effective in cutting down losses . . . never gets out of commission.

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Approved by R.E.A.

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GROUND ROD is held firm, while it is being driven, by a series of guide plates suspended 18 in. apart on chains attached to lower end of the hammer

Special Rig for Faster Driving of Ground Rods

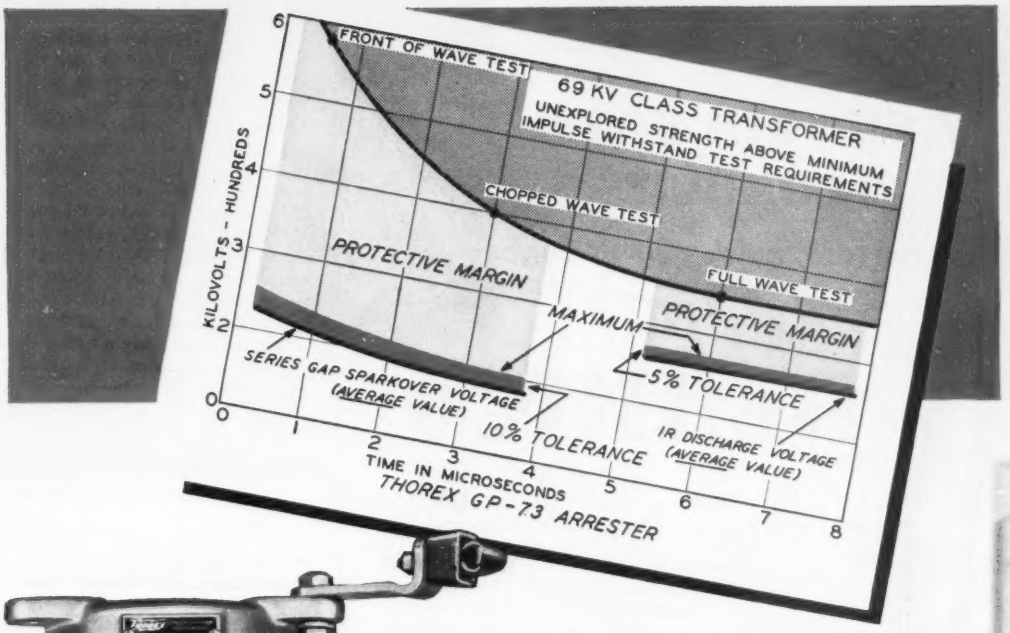
A ground rod driving truck has been devised by Copperweld Steel Co of Glassport, Pa., to facilitate deep grounding. The ¾-ton demonstration truck, carrying a demountable steel framework that supports a gasoline hammer, is particularly suitable where a considerable number of rods are to be driven as when erecting a transmission line. In many cases, the desired grounding resistance may be obtained more economically by deep grounding than by utilizing multiple grounding.

Channels Form Track for Hammer

The steel frame work consists of a stationary part, bolted to the truck bed, which supports a movable derrick made of two 4-in. steel channel sections 13 ft long. The channels are spaced about 18 in. apart to form a track for the gasoline hammer. Plates at top and bottom of the hammer center it between channels. A steel cable and hand-operated winch serve to raise or lower the hammer in the derrick. Driving chucks for the hammer are available for ground rods of different diameters.

A series of rod supports or guide plates, spaced 18 in. apart, are suspended from chains attached to the lower end of the hammer. By preventing the rod from whipping or bending during driving, they insure full use of the hammer's impact.

Equipment design keeps the derrick



YOU GET MORE PROTECTION WITH THOREX ARRESTERS

Between two *standard* conditions--apparatus impulse insulation strength and published average lightning arrester performance--exists a zone called "Protective Margin". The accompanying graph illustrates this. But two factors that are not standard may shrink this margin to the point where protection is critically reduced.

Apparatus insulation may have a lower value than that shown as specified for new, modern equipment. Older insulation standards or unavoidable abuse may force the minimum downward, sometimes to an unknown degree, and thus materially invade Protective Margins from above.

For this reason, it is of vital importance to many operators that all controllable factors that would preserve the Protective Margin be used to their fullest advantage. Such a factor is the low operating tolerance in O-B Thorex valve type lightning arresters. This efficient protective device guarantees less than + 10 per cent sparkover and less than + 5 per cent IR discharge voltage tolerance, both being the lowest tolerances ever offered on the American market.

O-B Thorex arresters give you *greater* apparatus protection because their close operating tolerance deducts the *least* from Protective Margins. Buy the greater safety now available in the O-B Thorex.

Ohio Brass

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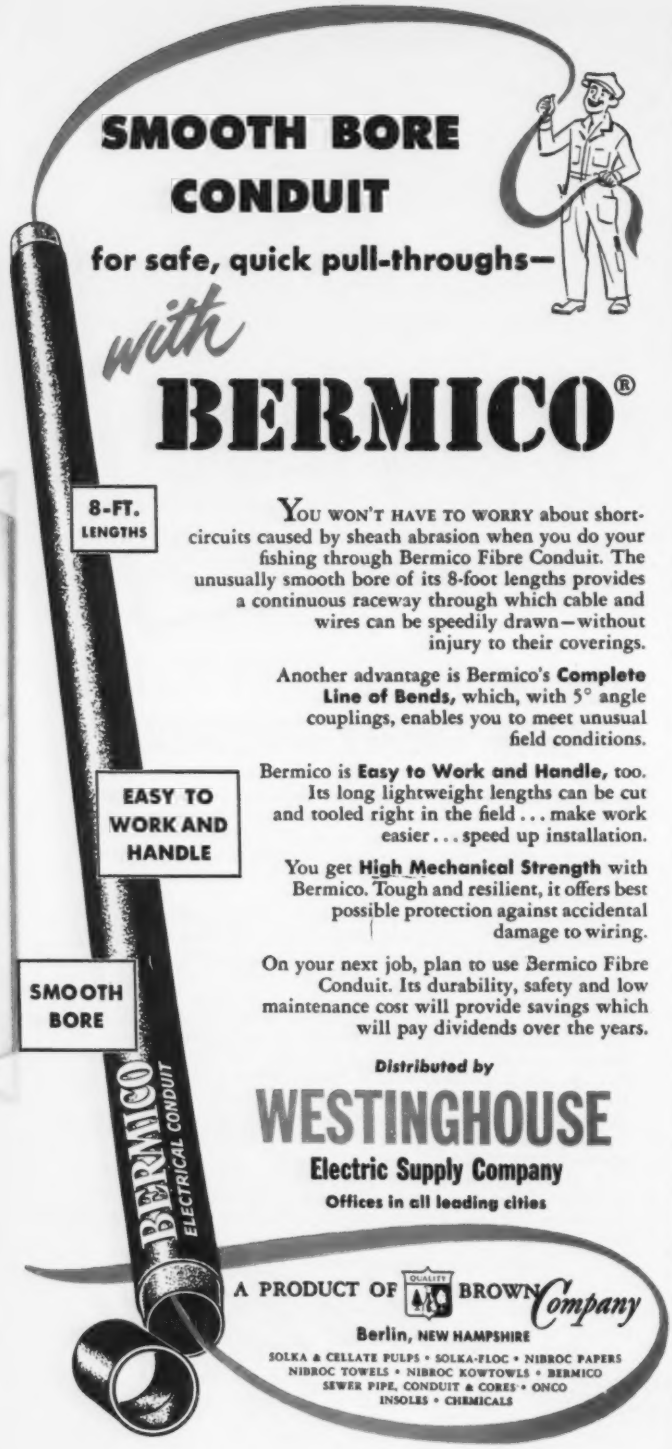
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EASY TO WORK AND HANDLE
SMOOTH BORE
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You won't have to worry about short-circuits caused by sheath abrasion when you do your fishing through Bermico Fibre Conduit. The unusually smooth bore of its 8-foot lengths provides a continuous raceway through which cable and wires can be speedily drawn—without injury to their coverings.
Another advantage is Bermico's Complete Line of Bends, which, with 5° angle couplings, enables you to meet unusual field conditions.
Bermico is Easy to Work and Handle, too. Its long lightweight lengths can be cut and tooled right in the field . . . make work easier . . . speed up installation.
You get High Mechanical Strength with Bermico. Tough and resilient, it offers best possible protection against accidental damage to wiring.
On your next job, plan to use Bermico Fibre Conduit. Its durability, safety and low maintenance cost will provide savings which will pay dividends over the years.
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plumb even though the truck may be on a slope. Derrick can be lowered to a horizontal position above the truck body if the equipment is to be moved any great distance.

To operate this equipment, a coupling and driving stud are first screwed on the upper end of the sectional rod. With the hammer raised to the top of the derrick, top end of the rod is inserted into the chuck, and the guide plates attached. The hammer is started and, as the rod is driven into the ground, the hammer lowers to keep its full weight on top of the rod. Sections of rod are driven until measurements indicate the desired resistance has been secured.

Rubber Pads Insulate L-V Cable Joints

V. A. VEIT
Assistant Engineer
Transmission and Distribution Bureau
Consolidated Edison Co of N. Y., Inc.

Rubber insulating pads applied to low-voltage non-leaded cable joints are giving improved protection against general deterioration under average field conditions. The pads are a development of Consolidated Edison Co of New York, Inc.

These rubber insulating pads consist of three layers of rubber with a rubberized cloth cover on the outer side and a removable Holland cloth on the inner side. These pads are made in various sizes and shapes for specific types of cable joints. A typical rectangular shaped pad is illustrated (following page).

Composition of the Pad

Outer layer of rubber adjacent to the rubberized cloth covering is 3/64-in. thick and is made of vulcanized rubber containing anti-oxidants. The center layer is also 3/64-in. thick and is made of partially vulcanized rubber containing accelerators and anti-oxidants. The inner layer is 3/32-in. thick and is made of unvulcanized plastic rubber containing anti-oxidants but no accelerators. These three layers of rubber and the cloth covering are bonded to form a sheet.

After cable joints are prepared in the usual manner the Holland cloth is removed from the pads and the pads are wrapped tightly around the joints with the unvulcanized layer of rub-

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* * *

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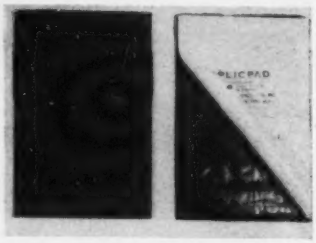

RUBBER INSULATING PAD has outer layer of vulcanized rubber (left), center of partially vulcanized rubber, and (right) inner layer of unvulcanized rubber covered by Holland cloth

CABLE JOINT assembled with rubber pad, half-lapped friction tape, and a coat of oil-resistant paint

ber in contact with the joint. Edges of the pads are overlapped about 1 in. and the pads extend over the cable insulation about 1.5 in. thereby making a water-tight joint. The rubberized cloth is removed from the 1-in. overlapped edges of the pads. Two tightly wound half-lapped layers of friction tape are applied over the whole assembly to cause the unvulcanized layer of the pads to adhere strongly to the prepared surfaces and to force this plastic layer of rubber to conform to any irregularities. A coat of oil-resistant paint is applied over the friction tape to complete the assembly.

Center Layer Continues Self-Cure

Outer layer of vulcanized rubber provides resistance to deteriorating agents. The center layer of partially vulcanized rubber having the accelerators and anti-oxidants will continue to self-cure. Some of the accelerating material in this layer diffuses into the unvulcanized inner layer of rubber thus causing a partial curing to a depth of approximately 1/32 in. The remaining 1/16-in. depth of this unvulcanized layer retains its tacky quality necessary for good adhesion to the surfaces over which it is applied.

In addition to the improved protection, the use of these rubber insulating pads in lieu of rubber tape makes for a reduction in cost.

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Westinghouse engineering and design have solved many special problems, such as protection for 500-kv systems. The same research, engineering and manufacturing know-how goes into standard arresters for your everyday needs.

For your special *and* everyday protection problems—whether it's a transmission line . . . a substation . . . or a distribution feeder—it will pay you to be sure. Specify Westinghouse. We'll be glad to help on any lightning protection problem. Simply call your Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

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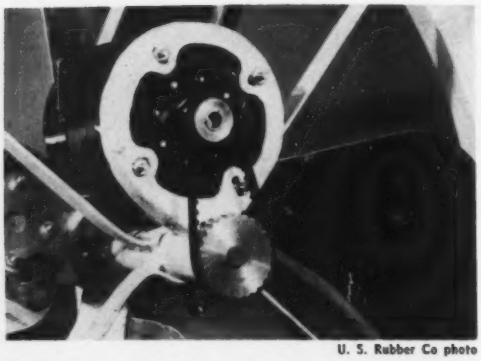
- **Type L "De-Ion" Tube**—for protection of transmission lines at voltages from 13.8 to 138 kv.
- **Type LV Autovalve**—for protection of distribution apparatus at voltages from 3 to 15 kv.
- **Type A "De-Ion"**—for protection of distribution apparatus at voltages from 3 to 15 kv. J-60725

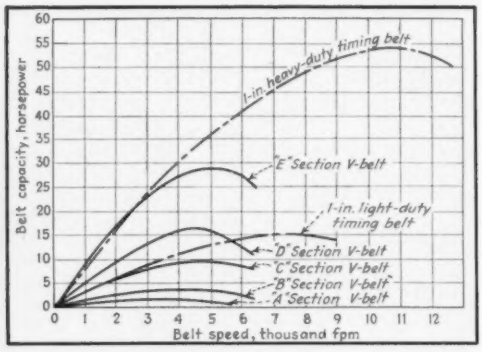
Westinghouse

LIGHTNING ARRESTERS



U. S. Rubber Co photo

TOOTHED BELT has positive engagement with toothed pulley. Makes possible such small drive on this fan. Company says it will not slip, permits split-second timing, will attain speeds up to 16,000 ft per min, and operates more quietly than precision gears running in an oil bath



THEORETICAL HORSEPOWER RATING CURVES showing comparison between the proposed stock heavy and light duty timing belts and the five standard multiple V-belts. Graph indicates the timing belts will transmit more horsepower and peaks at higher speed than V-belts

Timing Belt with Teeth that Do Not Slip

A rubber and fabric belt with teeth that may fulfill the need for a power drive which will not slip and that permits split-second precision timing has been recently developed by U. S. Rubber Co. It is claimed to attain speeds up to 16,000 fpm, and operate more quietly than precision gears running in an oil bath.

The new belt has replaced flat belts, V-belts, chain drives and gears in many applications as a more economical and efficient means of power transmission, according to the company. They claim successful service records in color television, on commercial sewing machines, in floor polishers, sanders, saws and other portable tools; in fan belt service by two automotive manufacturers; and on portable chain saws. Other successful applications claimed for the belt include electric typewriters, automatic screw machines, etc.

It is said to achieve greater uniformity in the productive rate of industrial machinery. The belt is similar in appearance to a flat belt except that it has regularly spaced rubber teeth along its inner surface which engage in corresponding grooves in the pulleys. It can be made in any size and in a variety of materials.

Relighting Gives 700% More Light at Half The Cost

Power consumption costs are halved and heat radiation reduced 90% with this new fluorescent lighting system installed in the engineering drafting department of the Harley-Davidson Motor Co, Milwaukee, Wis. A 700% increase in working illumination is provided as compared with the previous incandescent system.

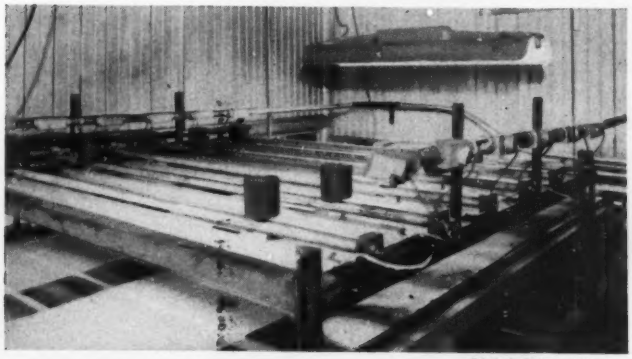
Initial intensities of over 100 ft-c of shadowless light are available to engineers, eliminating disturbing shadows from instruments over working surfaces. The 2,300 sq ft rectangular

SHADOWLESS LIGHT of over 100 ft-c is provided on working surfaces in 2,300 sq ft drafting room. There are 79 4-ft units, each with 4 40-w soft-white tubes

room has 79 four-foot fixtures, each having 4 - 40-w fluorescent 4500 K soft-white lamps.

The interlocking louvers of the all-white finish fixtures permit 45 deg cut-off, and 20% of the light is thrown against the ceiling while 80% is directed downward.

Radiant Heaters Dry Plastics Faster



Edwin L. Wiegand Co photo

PLASTIC DRYING rate is increased 1/3 with six 2,275-w, 230-v infrared radiant heaters having same Btu output as previously-used method. Heaters are turned away from web in case of stoppage of product flow

An installation of electric infrared radiant heaters was recently made by an eastern manufacturer for drying the vinyl sheets used in making safety glass. The problem was to completely dry the sheeting prior to sandwiching it between the two sheets of glass. The drying rate has been increased ⅓ with the same Btu output as the formerly used method. Heaters provide absolutely uniform heating across the vinyl sheet and a high moisture absorption with no hazard of breaking.

In order to completely dry the vinyl sheets, they are passed under six infrared 230-v, 2,275-w radiant heaters, each with an overall length of 61½ in. and a heated length of 48 in. The conveyor has a width of 48 in. and a speed of 22 fpm. Total radiation exposure time is 15 sec.

Heaters are placed on 10 in. centers and mounted 6 in. above the vinyl sheeting. In the event of stoppage of product flow, heaters are turned away from the web by means of a mechanical lever operating through a connecting linkage. Counter-balances to facilitate rotating are mounted on each heater. A solenoid-controlled air-pressure piston is being installed so as to turn the heaters from the web automatically.

For the drying operation, the web continues, carried horizontally into a cooling room, maintained at 68 F and a 20% relative humidity. The web is automatically carried on to a swinging type drying rack, which festoons in a manner similar to that done with cloth in a drying room of a textile plant. This is for the purpose of cooling, which requires 5 min. as the temperature of the web has been raised to 150 F in the drying operation. After leaving the festoons, the sheeting is rerolled in the cooling room and is then shipped to the department where the safety glass is actually fabricated. At this point, the total moisture content of the vinyl sheeting has been reduced to approximately 0.5%.

The ventilation in the drying room is accomplished by means of a duct and blower which introduces air into the room near the ceiling. The air is directed downward and travels to the vinyl sheeting. The blower operates under about 0.5-in. static pressure. The air is exhausted through a small number of openings in the side wall. This wall was designed to minimize the air turbulence which if occurring, might well cause the vinyl sheeting to vibrate or flutter.

INDUSTRIAL BRIEFS

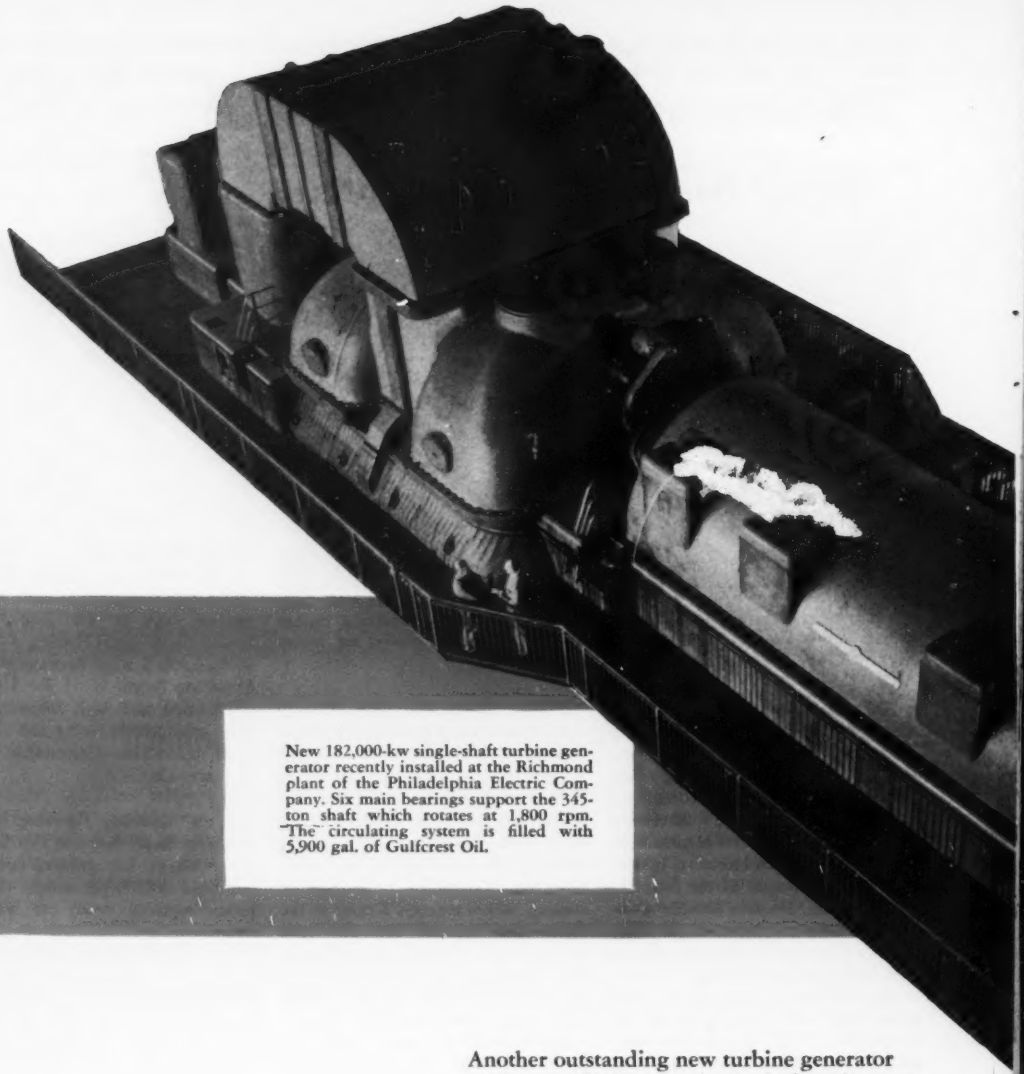
Electric Heating has replaced coal fired steam heating in the Nashville shops of the Nashville, Chattanooga & St. Louis Railroad and saved $10.-000 in operating costs in first season. Space heating of 238 kw is installed in 12 buildings—water heating 28 kw, sand drying 25 kw, oil house 18 kw, waste house 5 kw. Total operating cost for past year was $4,200. Cost of electric heating equipment installed was $9,500. Railroad is electrifying all outlying stations requiring labor to provide space heat.—A. C. Gibson and H. S. Evans, Jr, power sales engineers, Nashville Electric Service, Nashville, Tenn.

Office Lighting of 50 ft-c is secured at U. S. Rubber Company's Chemical Division in Naugatuck, Conn., by continuous lines of 8-ft long fixtures spaced 7 ft apart having standard 40-w, 4,500 K white fluorescent tubes. Mounting height is 11 ft. Uniform distribution and high intensity provides comfortable seeing and efficient office operation.—Connecticut Light & Power Co.

Modern Materials Handling at the Southern Scrap Material Co, Ltd, of New Orleans, La., reduced operating cost $400 to $500 per month. Electric power replaced steam for handling scrap metal.

The new overhead electric crane requires only one operator as compared to an operator and fireman for each of two locomotive cranes formerly used. Track space needed for the two locomotive cranes became available as storage area and greater stocking height is possible with the new electric crane. The high speed and flexibility of the new crane permits rapid movement of materials from one end of yard to the other.

New crane is 42 ft high, 110 ft wide, operates from a 440-v, 3-phase service on an 800-ft long overhead track. Operator can use either a 65-in. electromagnet or a hook with a capacity of ten tons to handle scrap metal. Total load is 140 hp. Annual usage is 110,000 kwhr—O. V. Baldwin, Industrial & Commercial Division, New Orleans Public Service Inc.



New 182,000-kw single-shaft turbine generator recently installed at the Richmond plant of the Philadelphia Electric Company. Six main bearings support the 345-ton shaft which rotates at 1,800 rpm. The circulating system is filled with 5,900 gal. of Gulfcrest Oil.

Another outstanding new turbine generator —the world's largest single shaft unit—gets the safe, sure, long-lasting protection of Gulfcrest Oil.

This tremendous unit, with turbine and generator rotors coupled together to make a single shaft 95 ft. long, has an output of 182,000 kw. Steam conditions at the throttle are 1250 lbs. per sq. in. at 950°F.

And here's another example of a prominent utility which again and again has selected Gulfcrest Oil for new turbine units. Proof of their confidence in Gulfcrest can be found in the rated output of all its units lubricated by this unmatched turbine oil. They total more than 1,600,000 kw!

Extra refining makes the difference! After the

Gulfcrest Oil

selected for world's largest single-shaft turbine

carefully selected crude oil used in Gulfcrest goes through the major refining methods, it is then superrefined by the Alchlor Process.

This exclusive Gulf process removes the hydrocarbons most apt to oxidize and form sludge, emulsifiers, and harmful acids in turbine lubricating systems.

That's why Gulfcrest is incomparably pure—why it gives outstanding performance, and lasts indefinitely in turbine lubricating systems. Call in a Gulf Lubrication Engineer today for complete information on this superior oil. Write, wire, or phone your nearest Gulf office.

Gulf Oil Corporation · Gulf Refining Company
Gulf Building, Pittsburgh 30, Pa.

FIFTY YEARS OF SERVICE
1901 GULF 1951
PETROLEUM AND ITS PRODUCTS

SALES AND SERVICE

RESIDENTIAL • RURAL
COMMERCIAL

Home Lighting Game Stops Show Visitors

Best way to attract and hold people's interest is to offer them free a chance to win something. This way has been used by the Cincinnati Gas & Electric Co to promote modern home lighting on a couple recent occasions.

On the background of an exhibit booth are 16 framed pictures each suggesting some application of "Eye Comfort" home lighting. Accompanying text tells how little electricity cost for the particular use. All of this is reproduced on plastic and lighted from behind.

The front counter has 16 toggle switches, each one controlling a "Picture of Comfort." Visitors were asked to select and throw a switch and examine the picture thus lighted up. When all the pictures were turned on, the attendant threw the giant jumbo toggle switch in the center of the display which caused the individual pictures to flash in varying sequences. Finally, only one picture remained lighted and the person at that switch received a symbol of eye comfort—a 100-w lamp. At regular intervals, an "Eye Comfort" lamp was lighted automatically which gave the attendant an opportunity to demonstrate a method of modernizing a lamp. The person with the winning picture received a bonus—a pin-up lamp.

WAITING FOR PLACES at toggle switches as attendant starts pictures flashing

Approximately 28,000 persons played the game when it was presented at the Cincinnati Home Show and it was a traffic stopper at the Pure Food and Homemakers Show held at the Cincinnati Zoological Gardens last summer.

Domestic Usages of Electricity in Britain

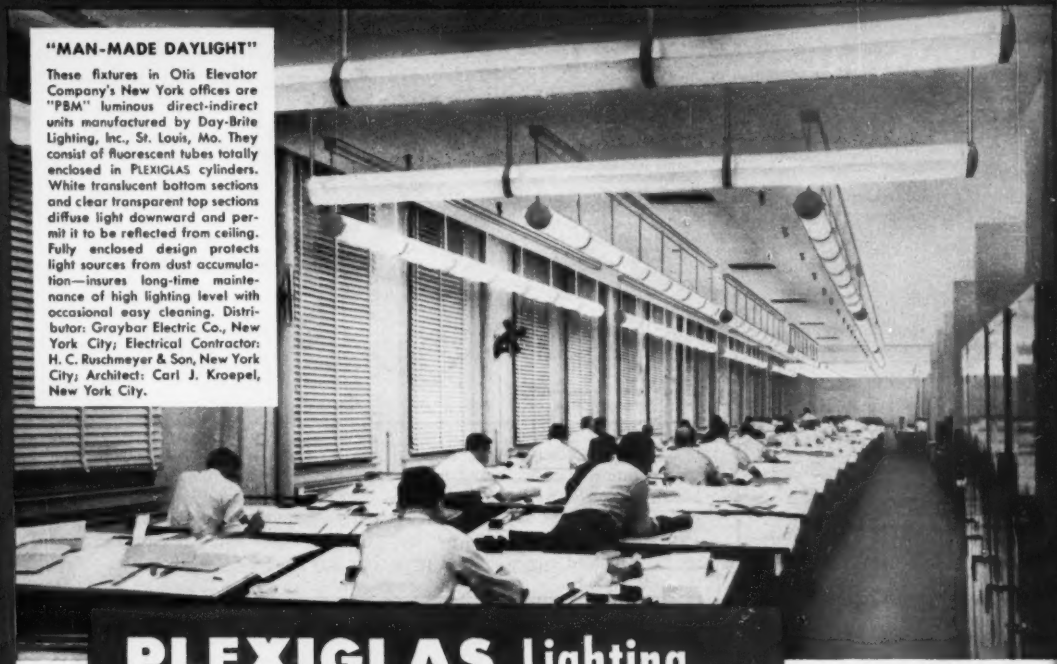
The British electric cooker apparently uses more electricity in a year than an electric range does in this country. The nominal annual consumption of a range here is taken as 1,100 kwhr. But according to the accompanying tabulation the cooker uses 1,420 kwhr. These figures were taken from "Utilization Research Report No 4," published recently by the British Electricity Authority. They are based on a sampling survey of domestic consumers made by the Electrical Research Association in 1946. The survey covered 60 former electricity supply systems (nationalized since) serving over 3 million domestic consumers. Well over 50,000 individual data sheets were accumulated in the survey. The consumptions of appliances in the table are the result of punch card analysis of these data.

The reader who is unacquainted with electric appliances used in Britain may be a little puzzled by some of the designations in the table. The "kettle" has had some promotion in this country but it never attained large acceptance. So also is the case with the "sink heater" which is an open-type heater of one to two gallons capacity mounted over the sink. The "wash boiler" is a laundry tub on castered legs with a heating element of up to 5 kw built in. The immersion heater is the same as here, evidently sold to domestic customers for insertion into existing heater tanks or other water containers.

The figure of 1,420 kwhr annual consumption of the cooker, stated above, is that for all consumers "with kettle, without sink-heater" in the table. This figure probably comes nearest to ordinary use of the range in this country where a certain amount of water for cooking uses is brought to boiling point on the range.

The sink-heater, wash boiler, and immersion heater can be taken as supplying hot water for the same uses as the storage water heater does here. Their combined energy consumptions add up to 2,965 kwhr, somewhat less than the nominal usage for water heating in this country.

The differences between "credit" and "prepayment" meters in energy for the various uses is striking. Customers in the first meter group are billed and in the second they put coins in the meter. The prepayment customers use less electricity for light-



"MAN-MADE DAYLIGHT"

These fixtures in Otis Elevator Company's New York offices are "PBM" luminous direct-indirect units manufactured by Day-Brite Lighting, Inc., St. Louis, Mo. They consist of fluorescent tubes totally enclosed in PLEXIGLAS cylinders. White translucent bottom sections and clear transparent top sections diffuse light downward and permit it to be reflected from ceiling. Fully enclosed design protects light sources from dust accumulation—insures long-time maintenance of high lighting level with occasional easy cleaning. Distributor: Graybar Electric Co., New York City; Electrical Contractor: H. C. Ruschmeyer & Son, New York City; Architect: Carl J. Kroepel, New York City.

PLEXIGLAS Lighting...

Cuts Shadows without Substituting Glare

When shadows get caught on the point of a draftsman's pencil—or glare gets in his eyes—plans are bound to suffer. Otis Elevator Company ended these frequent drafting-room annoyances with a new type of PLEXIGLAS lighting fixture. Now there's no trouble with shadows or glare on the drafting tables.

In offices, plants, schools, public buildings, and homes, white translucent PLEXIGLAS leads to good lighting. It gives high level illumination with low source brightness. Result:—Full, pleasant lighting that lets you see without eyestrain.

PLEXIGLAS is easy to erect and maintain, in luminous ceiling installations, coffer lighting, and individual fixtures. Light weight and shatter-resistance mean safety overhead, and low-cost maintenance in the bargain. Full information on PLEXIGLAS acrylic plastic for lighting is yours without obligation.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

• A steadily increasing percentage of PLEXIGLAS production, now at record levels, is required for the defense mobilization program. The supply available for civilian applications is limited.

PLEXIGLAS *is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries. Canadian Distributor: Crystal Glass & Plastics, Ltd., 54 Duke Street, Toronto, Ontario, Canada.*

EVERSTICK ANCHORS...

FIRST CHOICE

for

- PERMANENCE
- HOLDING POWER
- LONG LIFE
- SAFETY

They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install — made of tough rust-resistant malleable iron — their holding power "tops" all others. Available two-way, three-way, four-way and cone types. Write for facts.

Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.

Manufacturer of

"THE ANCHOR OF MERIT"

FAIRFIELD, IOWA

Average Annual Consumptions of Electricity For Specific Uses in Britain

Use	All Consumers	Urban Consumers	Rural Consumers	Type of Meter: Credit	Type of Meter: Prepay't
	Kwhr	Kwhr	Kwhr	Kwhr	Kwhr
Lighting and miscellaneous	175	175	175	225	145
Radio set	65	60	40	40	75
Iron	50	60	——	40	65
Kettle	185	160	260	170	120
Cooker					
All categories	1,400	1,380	1,360	1,360	1,610
Without kettle, without sink-heater	1,540	1,540	1,590	1,450	1,770
Without kettle, with sink-heater	1,060	1,020	——	995	1,060
With kettle, without sink-heater	1,420	1,430	1,320	1,420	1,640
With kettle, with sink-heater	885	795	583	575	——
Washboiler	450	460	445	365	615
Immersion-heater	1,560	1,560	1,460	1,610	845
Sink-heater	955	920	1,620	925	935
Space-Heating					
All categories	515	500	580	555	275
1 kw and below	145	145	120	140	145
1.1–3 kw	435	425	460	435	400
3.1–5 kw	975	935	1,130	985	635
Over 5 Kw	2,420	2,430	2,410	2,460	1,340
Average annual consumption of all consumers in group	1,035	1,000	1,325	1,160	650

ing, tea-kettle water heating and for space heating than do those who are billed. These can be termed convenience or comfort uses of electricity and are easily cut down by the economy-minded customer who pays as he goes. The larger usages for cooking and water heating on coin meters are explained in the report by larger saturations of this equipment in areas where alternate heat sources are less available.

HIGH-CEILING ILLUMINATION combines cold cathode lamps in square and circular coves with a centrally placed incandescent fixture for reflected light of low brightness

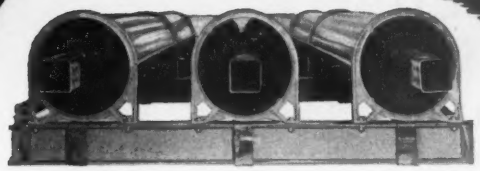
Combination Lighting for High Ceiling

Cold cathode and incandescent lighting form an unusual combination in the new Reading Terminal (Philadelphia) Horn and Hardart Restaurant.

The cold cathode lamps are installed in (a) four 13½-ft plaster-cast circular coves down the center of the high-ceilinged restaurant, (b) twelve 5-ft circular coves, and (c) 28 6-ft squares. An incandescent fixture is dropped from the center of the ceiling coves. Result is a low-brightness illumination reflecting from the white plaster coves and off-white acoustical tile ceiling.

A large clock in the rear of the restaurant is illuminated by cold cathode tubes which are located behind it.

REQUIREMENTS FOR A SET OF GENERATOR LEADS



ELECTRICALLY, THEY MUST

- carry the output with but one conductor per phase.
- not exceed a reasonable temperature rise.
- withstand overload without harmful effect to the conductor or its insulation.
- have a tight cover to prevent short circuiting by dust, moisture, etc., on the creepage surfaces of the insulators.
- have a minimum of bolted connections in bus run.
- protect against phase-to-phase short circuits.
- have insulation which is not harmed by heat or age.

MECHANICALLY, THEY MUST

- provide for expansion of bus and cover due to heat.
- withstand vibration.
- be adaptable to installation in congested areas.
- withstand thermal and mechanical stresses without damage or operating failure.
- employ porcelain and metals to their best advantage.

WHEN INSTALLED, THEY MUST

- present an attractive appearance.
- be easily put in place.

FOR INSPECTION AND MAINTENANCE, THEY MUST

- be easily accessible, permitting quick replacement of parts, particularly insulators.
- withstand periodic high-potential tests without damage to insulation.
- protect personnel who may come in contact with bus enclosure.

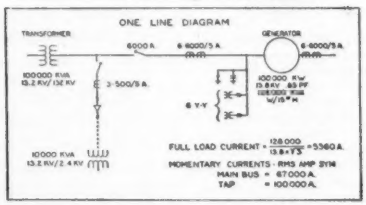
FOR ASSOCIATED EQUIPMENT, THEY MUST

- make provision for mounting disconnecting switches, instrument transformers, and protective devices.

I-T-E ISOLATED PHASE BUS MEETS ALL THESE REQUIREMENTS!

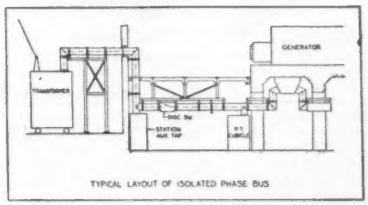
And it's as easy as this to order!

1. Give us a one-line diagram, like this —



2. Plus pertinent information about your building, generator, and transformers.

3. We will quote —



TYPICAL LAYOUT OF ISOLATED PHASE BUS

4. And then build *your* Isolated Phase Bus.

For further information, see your local I-T-E Representative, or write

I-T-E

ISOLATED PHASE BUS STRUCTURES

I-T-E Circuit Breaker Company • 19th and Hamilton Streets

Power Switching Equipment: Railway and Industrial Engine

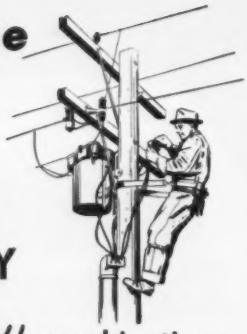
R&E

Factory Power Devices, Ltd.

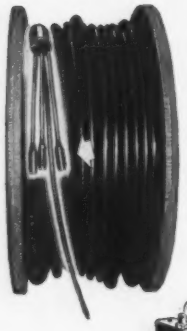
SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • RELAYS • SPECIAL PRODUCTS

By-pass Trouble

EFFECTIVELY EFFICIENTLY and EASILY



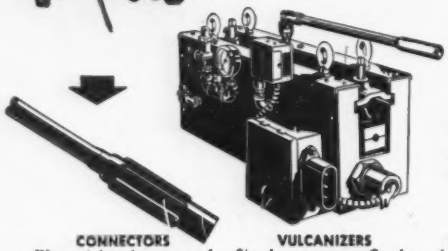
with JOY *Connector-Cable* combinations

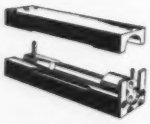


When nature or man-made catastrophies disrupt vital power and communication lines, time required to restore normal operations becomes extremely important. One of the most effective ways to minimize this *down-time* is to "Jumper" broken circuits with pre-fabricated JOY Cable-Connector combinations, until permanent repairs can be completed.

Shatter-proof, water-tight and amazingly resistant to wear JOY plugs, sockets and receptacles are available in a variety of sizes and designs that cover standard mechanical and electrical requirements. Factory molded as one-piece molded Neoprene units on 12" to 36" cable leads these plugs are shatter-proof, water-tight and wear-resistant. No special training is required to attach them to cable, and through use of JOY Vulcanizers and Molds even the insulation around the splice becomes an integral part of the cable jacket . . . See cable reel illustration at left.

ABOVE: Cable bushing and end block





CONNECTORS
Water-tight, shatter-proof and jerk-resistant. Available in a wide variety of sizes and styles for standard communication or power transmission needs. Factory molded as integral Neoprene units many are equipped with the famous JOY Water Seal. For complete specifications describe your needs or ask for Bulletin MC-108.

VULCANIZERS
Simple to operate. Can be used for patching cable, rejacketing splices or attaching JOY Connectors. When simple directions *included with each Vulcanizer*, are followed, completed splices are water-tight and wear-resistant. Two designs are available. 1—Steam heated 2—Directly heated . . . Both operate electrically. Bulletin RV-106 describes them in detail. Ask for your free copy now.

MOLDS AND SUPPLIES
Accurately machined in two identical half sections. Hundreds of sizes and many dimensionally correct styles have been developed to cover splicing, patching and pot-heading needs. For detailed information on them as well as JOY vulcanizing Tapes, Cements, and other supplies ask for Bulletin RV-106.

No question about it . . . JOY Connectors attached to rubber or Neoprene jacketed cable with splices insulated and jacketed through the use of JOY Vulcanizers make today's most dependable, electric jumpers. Completely portable and safe they will function perfectly on job after job with a minimum of maintenance attention.

Consult a Joy Engineer
100 Years of Engineering Leadership
M.E. 351.3

JOY MANUFACTURING COMPANY
HENRY W. OLIVER BUILDING, PITTSBURGH 22, PENNSYLVANIA
IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LTD. GALT, ONTARIO

UNATTENDED DEPOSITORY installed in a downtown department store by Sacramento Municipal Utility District is a big convenience for customers who can pay their bill while shopping. If customer does not have bill or exact change any overpayment is credited on next bill

Utility Customers Like Downtown Bill Depository

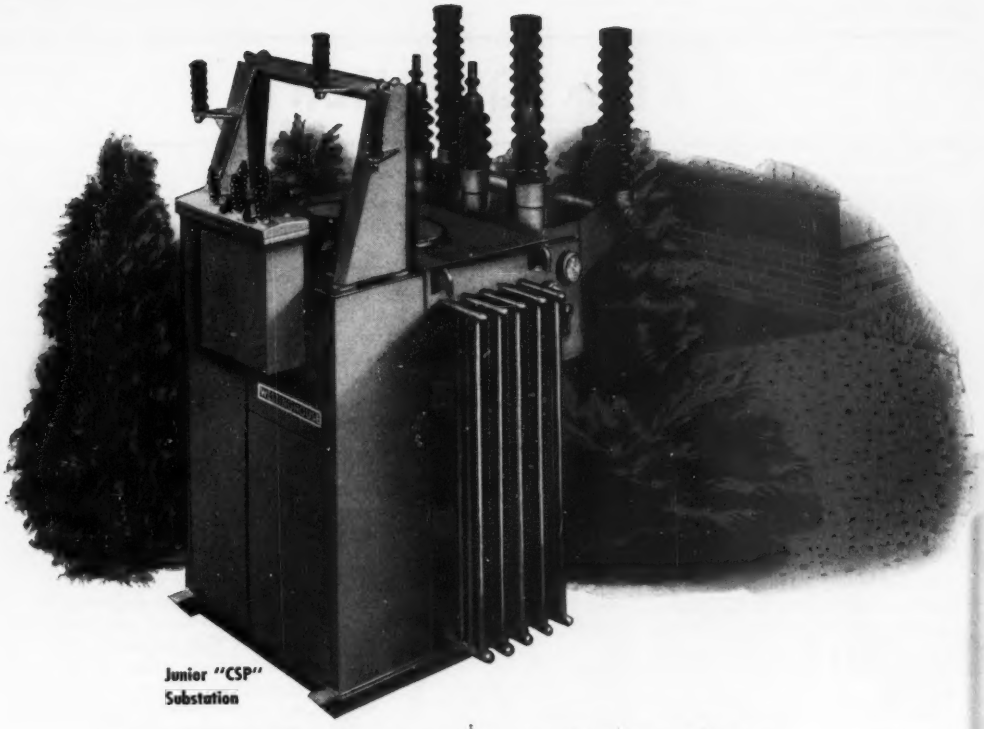
WILLIAM L. DUNCAN
Sacramento Municipal Utility District
Sacramento, Calif.

Nearly 2% of the 89,000 customers of the Sacramento Municipal Utility District used an unattended depository in a downtown department store to pay their bills during the first month it was in operation. The downtown location is convenient and of real service to shoppers, since the district has moved its offices away from the downtown area.

The depository is a special counter provided with a rack for envelopes in which bill and payment may be sealed and dropped through a slot into a built-in locked container under the counter. Full directions on use of the depository are printed on the envelopes. Customers need not have exact change or copies of their bills when using the depository—any excess payment is applied as a credit on the next month's bill.

Customers paying bills by cash check an indicated space on the envelope if they want a receipt, and it is mailed promptly. Of the 1,352 payments during the first month, only 522 requested receipts—an appreciable saving in clerical time, postage and handling expense.

The sealed payment envelopes are collected daily by armored car service. The depository is unattended except for the replenishment of pay envelopes at the counter. District personnel replenish a supply cabinet built under the special counter.



Junior "CSP"
Substation

A complete unit substation

—FOR SMALL CAPACITIES, too!

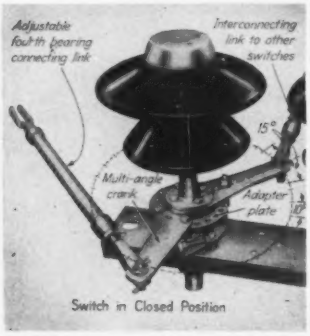
Here's a unit substation that answers small capacity needs. It's the Westinghouse Junior "CSP", a single-feeder substation that provides fast installation . . . greater flexibility . . . simplified maintenance . . . *at a much lower cost.* This new design is based on the principles proved in hundreds of larger rated "CSP" substations.

The Junior "CSP" (Completely Self-Protecting) Substation is completely factory-assembled, with integral high and low-voltage switchgear, and metering equipment. Thermal and lightning protection are both built in. It's ideal for rural lines, small towns and borderline areas where a larger rated substation is not justified.

Available in ratings from 300 to 1,000 kva . . . others to 3,000 kva. For further details contact your nearest Westinghouse representative, or write for Booklet B-4692, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70583

YOU CAN BE SURE.. IF IT'S
Westinghouse
JUNIOR "CSP"
POWER TRANSFORMER

NEW EQUIPMENT



Multi-Angle Switch Crank

No time is lost waiting for structure details before location of the operating handle can be determined when a new multi-angle switch crank is used. It is available, if specified, with R&IE air switches.

The crank permits angular adjustment of the switch crank to within five degrees of the desired location. This close adjustment, together with an adjustable connecting link, allows almost unlimited possibilities for fourth bearing locations on the structure.

Railway & Industrial Engineering Co, Greensburg, Pa.

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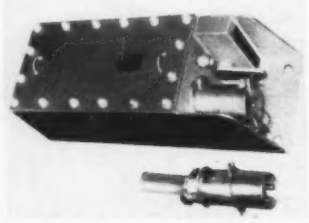

Pier Outlet Breaker

Supplying auxiliary power to ships at any dock or base is simplified by means of new pier outlet breakers. They can be placed along dock or pier to provide full protection for power cables and convenient disconnects.

Type AQB circuit breakers of Class HI design are used. They are available for either 250-v dc or 440-v ac, two- or three-pole service, with trip ratings from 70 to 600 amp. If more power is required, the units can be installed in groups.

Power from the breaker is fed to a standard watertight receptacle capable of interrupting its rated load. Receptacles can be supplied for either three- or four-wire service.

Westinghouse Electric Corp, P.O. Box 2099, Pittsburgh 30, Pa.

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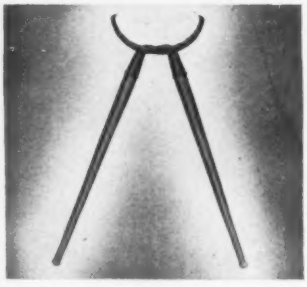


Pole Handling Tool

Working like a pair of ice tongs or huge pliers, is a new pole handling tool called the Pole Tong. It has jaws that close around and gig into the pole when the handles are brought together. Handles are long enough so that one man can secure ample leverage to control and position poles during pole setting operations. The tool is adjustable to three positions for handling different-size poles.

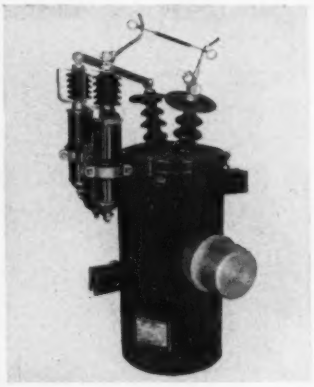
A. B. Chance Co, Centralia, Mo.

•

Voltage Regulator

Particularly adaptable to rural distribution lines, new single-step voltage regulators can be cascaded with minimum inter-reaction to bring voltage within tolerable limits. It is pole-mounted, OISC, 20-amp normal, 40-amp four-hour peak. On 7,200 and 7,620-v, 60-cycle grounded systems it will handle 300 kva, single-phase.

Features include a weight of 280 lb, minimum number of moving parts,



and quick-change sub-assemblies. It is controlled by an exceedingly over-damped contact-making voltmeter, manufacturer reports. The voltmeter is indicating as well as contact-making, and has a time integrated delay built into its switching drive.

Rural Transformer & Equipment Co, 632 N. 8th St, Milwaukee 3, Wis.

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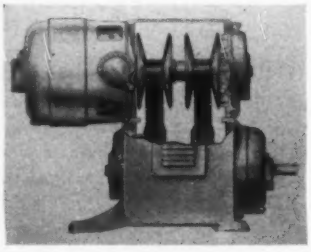
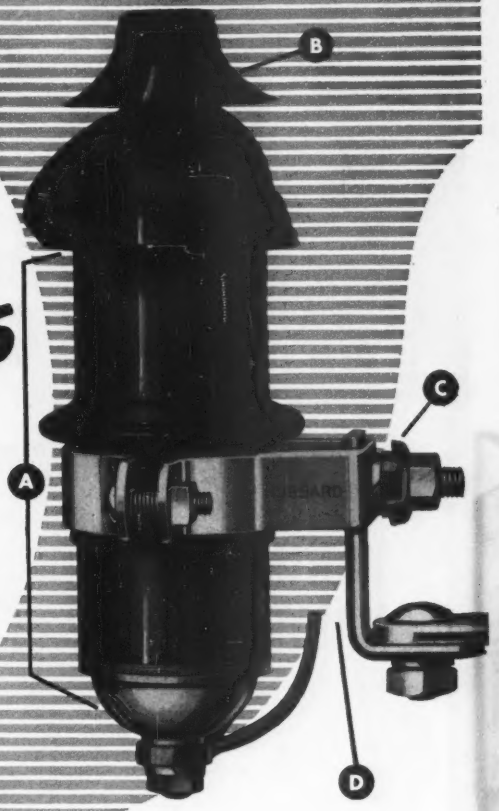


Variable Speed Motor

Dual varibelts have been incorporated in a line of extra-heavy duty motors for variable speeds, thus distributing the load so that no undue strain is imposed. Ratings are available to 50 hp.

To counterbalance belt load, tension control known as Autotaut has been designed. A calibrated spring is employed to maintain pressure between the two halves of the driven varidiscs and the sides of the belt. The spring takes up any slack that might be

ALL THE AUTOGAP ADVANTAGES plus LINE TERMINAL INSULATION



HUBBARD Line Insulated Autogap Lightning Arresters are the answer for utilities who do not approve of exposed hot line terminals. When lines are worked hot, exposed terminals present a constant hazard, especially on congested poles. The insulated line terminal also prevents bird trouble.

Electrically, these insulated Autogaps have the same characteristics as other Hubbard Vertical Autogap Arresters. Salient points are indicated in the illustration. The line terminal at the top of the arrester is protected by a bakelite cap.

The external gap is between the arcing horn and the "L"-shaped extension of the grounded mounting bracket.

Standard EEI-NEMA mounting brackets are supplied—No. 2337 for Crossarm mounting or No. 2338 for Pole mounting.

A *TWIN EXHAUST an exclusive Autogap feature, assuring maximum surge capacity.*

B *Bakelite insulator cap covering line terminal.*

C *Ground terminal attachment.*

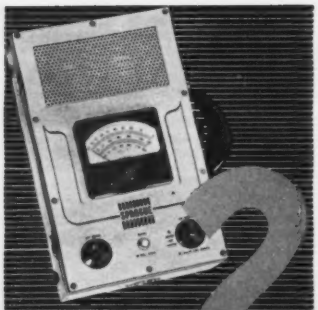
D *Air gap.*

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"



DON'T GUESS ABOUT WIRING!

SPRAGUE'S NEW

ADEQUATE WIRING ANALYZER

• Makes it quick, simple and easy to check existing wiring to see if it will safely carry proposed loads or if it is adequate for present loads. An effective visual convincer for your customers!

• Reads percent voltage drop under load directly on 115 or 230 volt circuits. Has direct-reading voltmeter for 115 and 230 volt lines.

• Furnished complete with connectors for convenience outlets, electric ranges, panelboards, etc.

Write for Bulletin PF-600

SPRAGUE ELECTRIC COMPANY

North Adams, Mass.

caused by stretch or wear of the belts. Motor speeds are changed by turning a control dial.

U. S. Electrical Motors, Inc, 200 E. Slauson Ave, Los Angeles 54, Cal.

•

Strip Chart Recorder

Up to six permanent records may be made on one chart by use of a new Multipoint Capacilog. This electronically-operated unit is a deflection type strip chart recorder which may be used with sensing units such as thermocouples, radiation detectors, etc.

This direct reading, non-balancing method of detecting changes in a measured variable is said to give results accurate to 0.25% of scale.

Wheelco Instruments Co, 847 W. Harrison St, Chicago 7, Ill.

•

Radiant Heating Panel

Nearly five feet high, but only 10¼ in. wide, the new Electriglas radiant heat Hi-Panel is particularly adaptable to the usually-limited wall areas of bathrooms.

Panel is available with a built-in thermostat, or for use with a separate wall thermostat. Once the dial is set, temperature is automatically maintained at any desired level for hours or months until the panel is switched off. The 1,000-w panel is for use with either 110 or 220 v; surface of the glass reaches about 300 F.

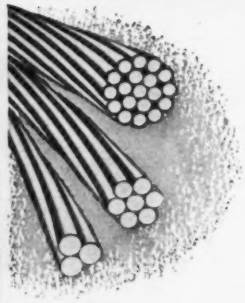
Appleman Glass Works, Bergenfield, N. J.

•

Control Amplifier

Particularly suited to dc measurement and control operations in industrial processes requiring continuity of

PAGE



Stainless Steel

STRAND

AND

Stainless-Copper

CONDUCTORS

Here's WHY they Save

Compared with other types strand of equal breaking strength, they . . .

- have 30-40% greater overload capacity within elastic limit.
- resist corrosion all the way through—not merely through a thin case of soft metal.
- offer highest tensile and vibration-fatigue strength (tensile strength 235,000 psi; corrosion-fatigue limit 50% of ultimate).

Here's HOW they Save

- They permit longer spans—therefore require fewer poles per mile.
- Being lighter, they are easier and faster to install in the field.
- More resistant to destructive factors, they last many times as long before replacement.

Let us tell you the whole story—

specific data, prices, recommended sizes.

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Portland, San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

ONE COAT TOWER PROTECTION AT ITS BEST!

SEE THE DIFFERENCE!
Dixon Paint lasts twice as long in Accelerated Weathering Test
DIXON PAINT
PAINT "X"
Dixon one-coat Transmission Tower Gray Paint
A widely used one-coat Transmission Tower Gray Paint
Photos taken after test by UNITED STATES TESTING COMPANY
DIXON
SILICA-GRAPHITE
PAINT
JOSEPH DIXON CRUCIBLE COMPANY

TWO COATS ARE BETTER — BUT —
where a one-coat job is planned — with costs being as they are — the life of the paint becomes even *more* important.

As shown above DIXON ONE-COAT GRAY gives long-life protection in UNITED STATES TESTING COMPANY'S impartial and crucial test.

Dixon Paint — practically as good as new — thanks to enduring Natural Flake Silica Graphite!

Paint "X" — a complete failure (and started to fail at the halfway point).

Dixon Paints are especially developed for transmission towers and other outdoor metal structures.

SEND FOR UNITED STATES TESTING COMPANY'S REPORT AND FOR NEW HELPFUL ENGINEERING MANUAL ON TRANSMISSION TOWER PAINTING — it's a working guide to efficient, economical protection of transmission towers. Contains valuable information never published before. Includes formulas for calculating cost elements.

DIXON
FLAKE SILICA GRAPHITE PAINTS

JOSEPH DIXON CRUCIBLE COMPANY
Paint Division, Jersey City 3, N. J., Dept. 4E

Without obligation please send me: ☐ Copy of your new engineering manual "Transmission Tower Painting" ☐ Copy of U.S. Testing Company Report on test of one-coat tower paints ☐ Have your salesman call on me

COMPANY_____

ADDRESS_____

NAME_____ TITLE_____

SPECIALISTS IN OUTDOOR PAINTS FOR METALS — FOR ALMOST A CENTURY

COLLECTS MORE DUST

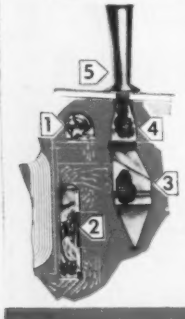
in the *ultra-fine* particle range

VALMONT TYPE S

With Prat-Daniel Dust Collectors, an extremely high percentage of the ultra-fine particles are removed from the gas stream. Long, narrow inlets on tubes of small diameter produce high efficiency even at reduced loads. The low velocity reduces erosion and combined with wear-resistant steel construction gives P-D collectors the desired combination of high efficiency and exceptionally long life.

All types of P-D Collectors meet the requirements of most dust ordinances; the high efficiency of the Valmont Type S, however, exceeds the requirements of many of the most stringent ordinances.

"Uni-block" construction, with complete tube sections assembled at the factory, makes relatively low installation costs possible. Hundreds of installations have proved P-D Collectors' all-'round efficiency and low maintenance costs provide a high return on investment. Get the best in dust collectors for your plant. Write our Sales and Project Engineers for Catalog No. 250S.



UNIT RESPONSIBILITY

Prat-Daniel, through its sales and project engineers, The Thermix Corp., offer a complete complement for handling the air gas stream shown at left: 1. Forced Draft Fans, 2. Air Preheaters, 3. Tubular Dust Collectors, 4. Induced Draft Fans and 5. Fan Stacks. This unit responsibility, by a well-known firm, relieves the engineer of the responsibility for one of the most important functions in a steam generating plant.

Sales and Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

Canadian Affiliates: T. C. CHOWN, LTD.
1440 St. Catherine St., W., Montreal 25, Quebec
50 Abell St., Toronto 3, Ontario

Designers and Manufacturers

PRAT-DANIEL CORPORATION

SOUTH NORWALK, CONN.

service, is the Model 1411 Inductronic amplifier. It is capable of measuring as an automatic process the related physical quantities of input devices such as thermocouples, radiation receivers, strain-gage bridges, resistance thermometers, and photocells. The amplifier also performs stepless control of temperature for precise regulation of baths, ovens, and comparable equipment having difficult thermal characteristics.

For measurement of magnetic flux, pulse energy, photographic exposure and the like, the amplifier permits high-speed integration of potential or current against time.

Dc to ac error conversion is accomplished by a new induction galvanometer. Amplifier output is a current having a range of 1 ma into a total load burden not exceeding 5,000 ohms (ie, 5 v).

Weston Electrical Instrument Corp, 641 Frelinghuysen Ave, Newark 5, N. J.

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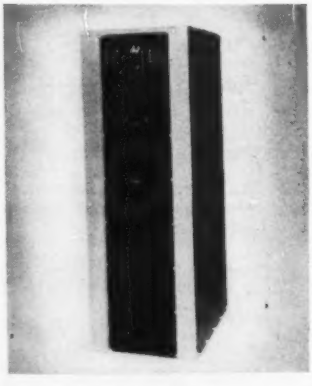
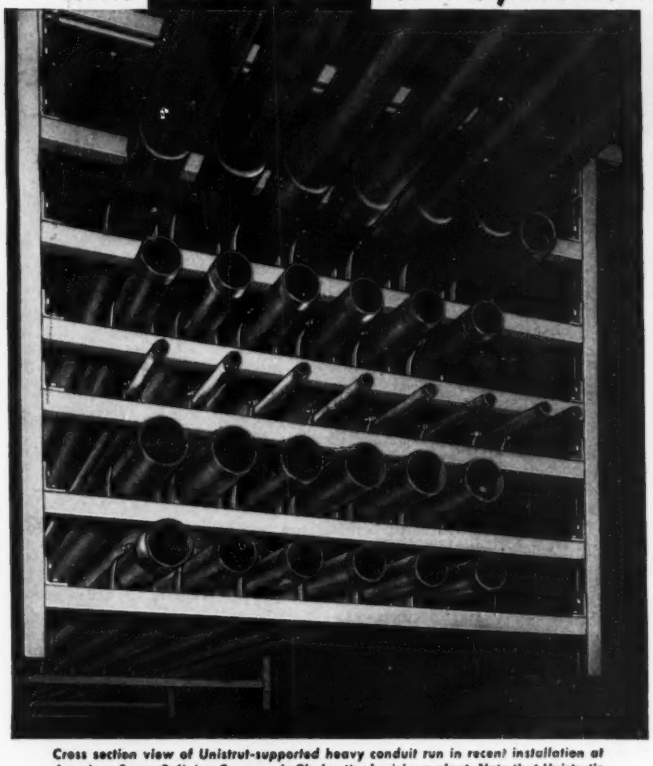


Induction Regulators

Both self-cooled and forced-air-cooled regulators are included in a new line of three-phase, dry-type, induction voltage regulators. They are offered in ratings from 120 to 600 v, 12 to 85 kva, in 10% and 20% (raise and lower) ranges of regulation. Cost

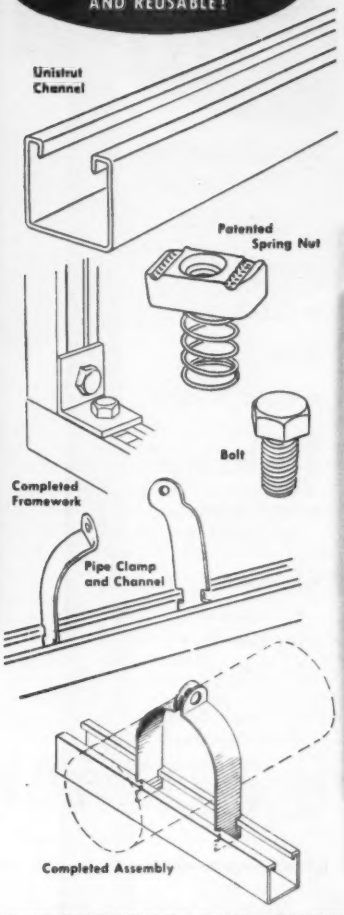
Rack Heavy Runs of Conduit

with UNISTRUT All-Purpose Metal Framing!



Cross section view of Unistrut-supported heavy conduit run in recent installation at American Sugar Refining Company's Chalmette, Louisiana plant. Note that Unistrut's flexibility makes possible later additions or changes.

NO DRILLING · NO WELDING
100% ADJUSTABLE
AND REUSABLE!



Try completely adjustable Unistrut framing the next time you have a pipe or conduit racking job. It's easy to use, requires little detailing time, fast to erect, and is capable of supporting great weight. It's trim framework, neat in appearance.

Unistrut's flexible design permits extreme accuracy of installation—adjustability to a fraction of an inch. Additional framework, clamps, or hangers may be added at any time quickly and easily, *without disturbing existing runs.* No drilling, no welding, no special tools or equipment needed. Unistrut saves time and money in erection and maintenance.

Representatives and Warehouse Stocks in Principal Cities consult your Telephone Directories.

U. S. Patent Numbers
2327587 2363382
2329815 2380379
2345650 2405631
Other patents pending

UNISTRUT

The World's Most Flexible All-Purpose Metal Framing

FREE CONSTRUCTION CATALOG AND WALL CHART Write today for your copy of 24 page Construction Catalog No. 500 and 24" x 36" Wall Chart!

UNISTRUT PRODUCTS COMPANY
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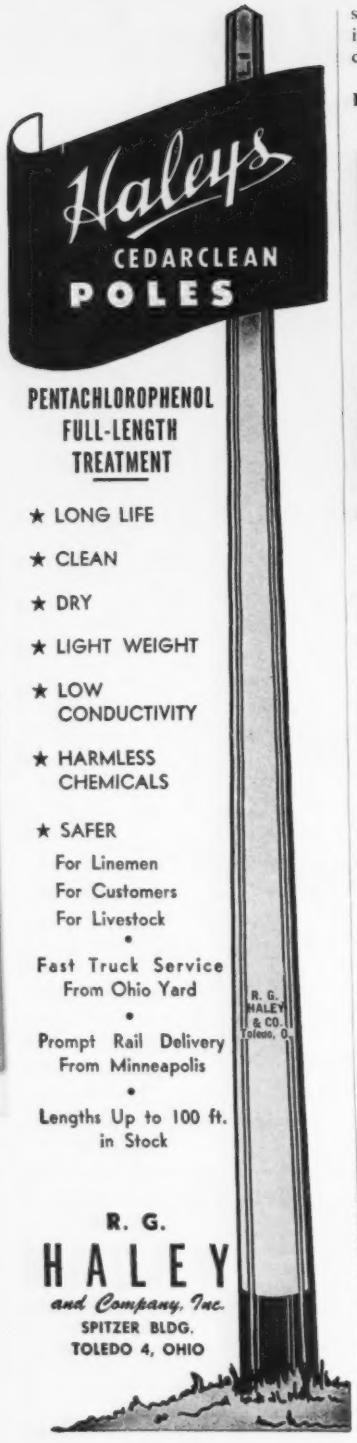
Please send the items checked below, without obligation:
☐ Catalog 500 ☐ Wall Chart ☐ Unistrut Sample

Name_____
Company_____
Address_____
City_____ Zone_____ State_____



PENTACHLOROPHENOL
FULL-LENGTH
TREATMENT

★ LONG LIFE

★ CLEAN

★ DRY

★ LIGHT WEIGHT

★ LOW CONDUCTIVITY

★ HARMLESS CHEMICALS

★ SAFER
For Linemen
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Fast Truck Service From Ohio Yard

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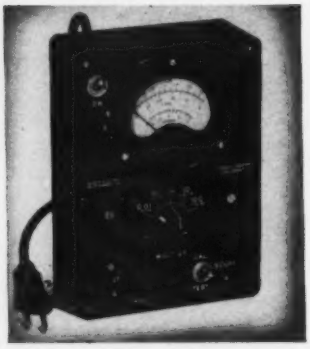
Lengths Up to 100 ft. in Stock

R. G.
HALEY
and Company, Inc.
SPITZER BLDG.
TOLEDO 4, OHIO

savings are made possible by arranging the phase windings on a single core.

General Electric Co, Apparatus Dept, Schenectady 5, N. Y.

•



Oscilloscope Calibrator

When used with any oscilloscope, Tensor A-42F oscilloscope calibrator permits measurements of voltages within the range 0.0005 v to 100 v rms, manufacturer reports. The calibrator is essentially a source of continuously variable monitored voltage over this range. It has the added feature of being calibrated directly in peak-to-peak volts and decibels as well as rms volts. It is housed in a molded case with an engraved and filled panel.

Tensor Electric Development Co, Inc, 343 Gudson Ave, Brooklyn 5, N. Y.

•

Plug-in Circuit Breaker

Plug-in TQL circuit breaker for 15 to 20-amp services features quick-make, quick-break operation and thermal-magnetic protection. A strong main operating spring opens and closes contacts so as to avoid excessive burning or arcing of the contacts.

The breaker is tripped by either of two impulses. Thermal action of the bi-metal trip element responds to an overload condition. Harmless temporary overloads will be passed without opening the circuit and magnetic action instantly opens the breaker in case of a short circuit.

Other features include pressure-type stabs, non-welding silver alloy contacts, and a completely sealed enclosure.

Trumbull Electric Mfg Co, Plainville, Conn.

Earth Augers

Ten-inch and 12-in. actual hole diameters are produced with new sizes of twin-helix Pengo earth augers. Aside from drilling ordinary ground, it is claimed that the auger will bore holes in hardpan, permafrost, and frozen ground. The twin-helix design eliminates back thrust against the side of the hole, making it possible to drill with less caving in, in sandy soil.

Petersen Engineering Co, 460 Kifer Rd, Santa Clara, Cal.

•

Tree Trimming Pole

In addition to greatly improved safety around power lines the manufacturer of a plastic insulator pole for tree trimming states that it will not splinter, crack, chip, or break under normal usage. Its weight is one-third that of a wooden pole.

The four-foot, 1.5-in. diam insulator poles may be joined to aluminum or wooden poles. Or they may be joined together with a special aluminum sleeve connecting unit. Available upon request is a booklet describing proper pruning techniques.

J. B. Sebrell Corp, 300 S. Los Angeles St, Los Angeles 13, Cal.

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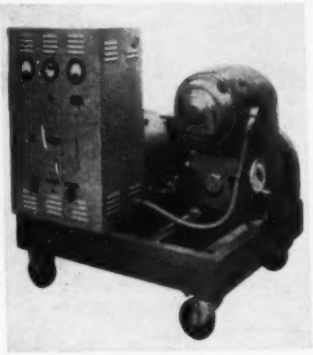
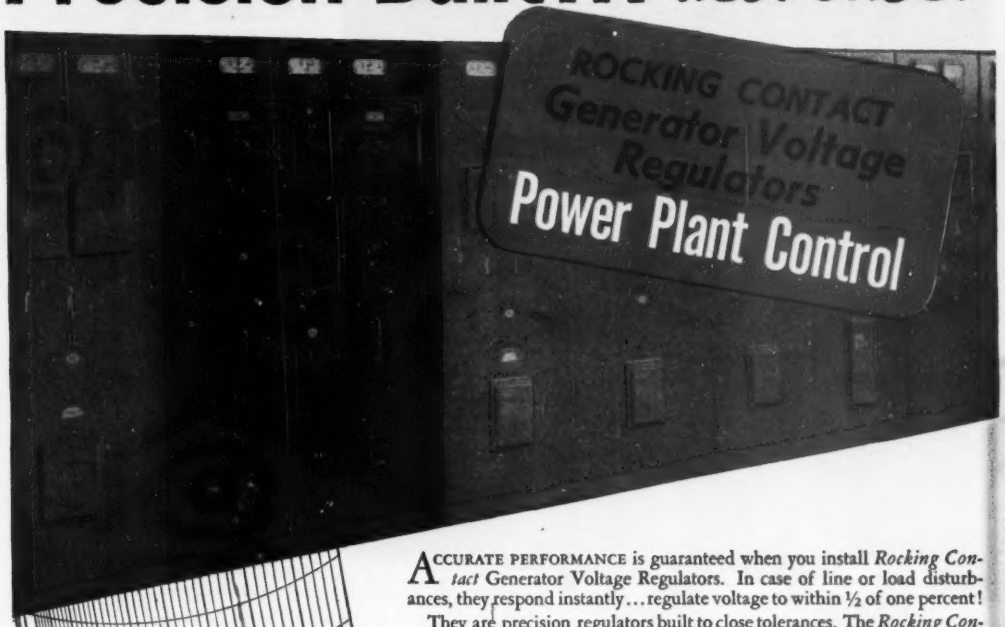


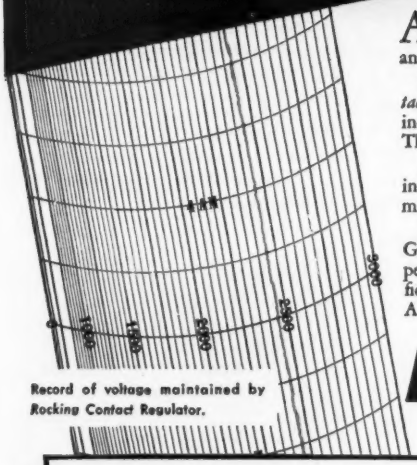
High-Frequency Alternator

Used as a power supply for induction heating units, calculators, X-ray, etc, a variable frequency alternator reportedly provides precise voltage regulation. It may also be used for motor drives on high-speed machines, tools, and instruments. The alternator is available in sizes up to 15 kva, single or three-phase, with frequencies to 2,400 cycles.

The induction alternator is equipped

Precision Built... FOR ACCURATE RESPONSE!





Record of voltage maintained by *Rocking Contact* Regulator.

ACCURATE PERFORMANCE is guaranteed when you install *Rocking Contact* Generator Voltage Regulators. In case of line or load disturbances, they respond instantly... regulate voltage to within ½ of one percent!

They are precision regulators built to close tolerances. The *Rocking Contact* commutator, for instance, is machined to within one thousandth of an inch. A silver surface is added to form a low resistance contact surface. Then the commutator radius is hand polished to friction-free smoothness.

All moving parts are tested and adjusted for perfect balance, then fitted into jeweled bearings. Resistance elements are individually designed to match the characteristics of your generator exactly.

It is this exacting design and workmanship that give *Rocking Contact* Generator Voltage Regulators their long lasting accuracy . . . "Not one penny spent for maintenance in fifteen years of continuous service," typifies the service users are getting. Call your A-C representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin for more information.

ALLIS-CHALMERS

Rocking Contact and *Synchro-Operator* are Allis-Chalmers trademarks.

Automatic Speed Control for Boiler Draft Fans

Draft fans operate at exactly the required speed for perfect combustion when Allis-Chalmers Type 257 Liquid Rheostats are used with wound rotor drive motors. Allis-Chalmers Liquid Rheostats are "application engineered" to provide straight line speed characteristics. Wide range stepless speed control is provided automatically . . . electrical, pneumatic or hydraulic pilot devices can be used. Write for Leaflet 14S7544.

Automatic Synchronizer for Rotating Machinery

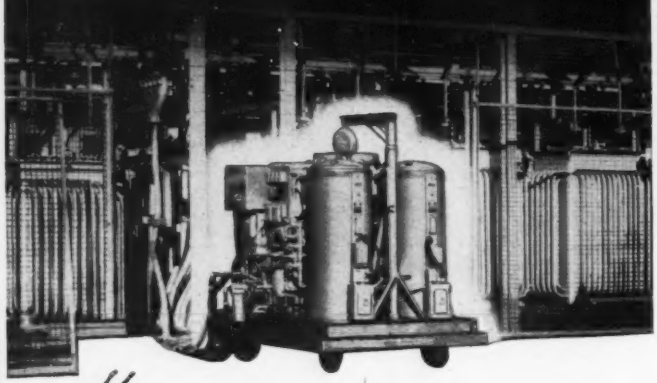
The *Synchro-Operator* (shown on the control panel with the *Rocking Contact* Regulators) controls the speed of synchronous condensers, alternators and frequency changers to bring them into synchronism automatically. While doing so, it indicates relative speed, the faster machine, phase angle between machines, and the exact point of synchronism. It automatically closes breaker at the exact point of synchronism. Only one *Synchro-Operator* is needed for any number of machines. Leaflet 14S6386B.

A-3294

Eliminate SHUT-DOWNS and EXPENSIVE REPAIRS

on Transformers, Turbines and Diesel Engines

with HONAN-CRANE Oil Purification Equipment



Many leading utilities such as Detroit Edison, Ohio Public Service Co., Pennsylvania Power, etc., have standardized on Honan-Crane oil purification equipment for removal of damaging contamination from insulating, Turbine and Diesel oils.

Honan-Crane can give you exact equipment to do the job. Equipment that will remove all types of oil contamination.

In every installation Honan-Crane equipment quickly pays for itself out of savings in oil and maintenance costs.

FOR TRANSFORMER INSULATING OILS

Houdaille Purivac (Shown Above)

A complete automatic system for purifying, dehydrating and degasifying insulating oil in the field or at a central location. For large volume purification requirements.

Honan-Crane "R" Type Purifier

Mobile oil reconditioning unit for centralized batch purification. Ideal for volumes of oil requiring capacities up to 200 G.P.H.

FOR TURBINE AND DIESEL OILS

Honan-Crane "M" Type Purifier (Right)

"Continuous" type purifier removes solid contamination as well as products of oxidation (acids, asphaltenes, gums and resins). Keeps neut. number and steam emulsion number within desired limits. Sizes to fit all needs.

● **Write today for Honan-Crane Bulletins: "Purification of Insulating Oils", "Purification of Turbine Oils".**

CL[illegible] OIL ENGINEERING

HONAN-CRANE CORPORATION

819 WABASH AVE., LEBANON, INDIANA

a subsidiary of

HOUDAILLE-HERSHEY CORPORATION

with an electronic exciter regulator; accuracy is reportedly within plus or minus one percent. To obtain variable frequency, it is driven by a variable speed electric power drive.

American Electric Motors, Inc, 4811 Telegraph Rd, Los Angeles, Cal.

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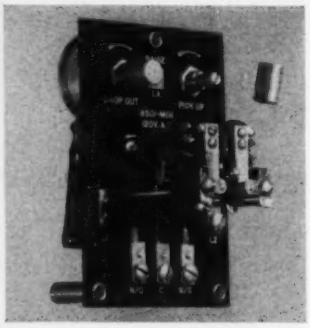


Voltage-Sensitive Relay

Its sensitive response to impressed voltage permits use of Class 8501 Type MO11 relay for a variety of either under-voltage or over-voltage operations. Contact arrangement is single-pole double-throw, making it especially adaptable as a pole device for indication or to actuate transfer contactors. Although designed for 110 v ac, it can be supplied for ac voltages to 550 v, as well as 115 v dc.

Square D Co, 4335 Valley Blvd, Los Angeles 32, Cal.

•

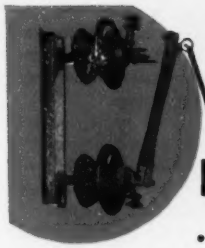
Solder Pot

Maximum temperature of 1,200 F attained by a new solder pot, Model No. 11, permits tinning Formex wire

CHANCE

Hook Stick Disconnect Switches

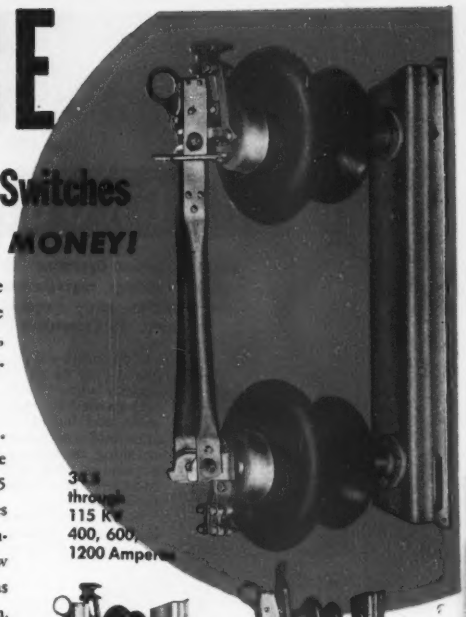
... MORE FOR YOUR MONEY!



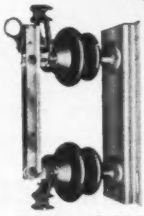
Chance Type BT Hook Stick Operated Disconnect Switches are made in a complete range of capacities for all types of single pole disconnect switch installations. They are available in single, tandem, or double throw types for horizontal mountings—upright, underhung, or vertical mountings up to 115 KV.

Dependable operation is inherent in their sturdy construction . . . RIGID CONTACT BLADES withstand heavy side thrusts, even if the closing force must be applied from an angle. Switches from 34.5 through 115 KV have a double tubular trussed blade which gives unequalled strength plus blade guides at the tongue which aid in contact alignment. 400 and 600 ampere switches rated 23 KV and below have reinforcing flanges on blades which increase rigidity and act as blade guides for closing the switch from an "out of line" position. 1200 ampere switches rated 23 KV and below have flat rigid parallel bus bar blades.

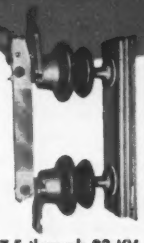
All Chance BT Switches have flanged bases that will not cut into wood supporting structures. Each size has been tested in accordance with A. I. E. E.-NEMA standards. Heat runs, high current tests, icing tests, insulation characteristics and life tests have proved the reliability of Chance Type BT Switches under all normal conditions.



34.5 through 115 KV 400, 600, 1200 Amperes



7.5 through 23 KV 400, 600 Amperes

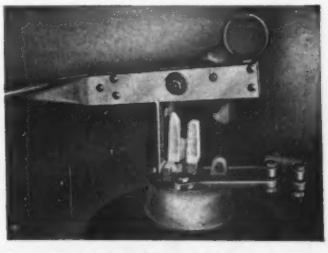


7.5 through 23 KV 1200 Amperes

Powerful Pryout for **EASY OPERATION**

A powerful lever action has been built into the pull ring mechanism and enables the operator to break ice or overcome clip adhesions with ease. All 400 and 600 ampere switches are equipped with time-saving built-in universal terminals. 1200 ampere switches have NEMA standard 4 hole terminal pads. Terminal lugs will be furnished on request.

Pressure Centered **LONG LIFE** Contacts



Pressure at the clip end is created by a conical compression spring combined with spherical washers. Split Tongue Contact casting "centers" spring pressure directly over contact area. All contacts are heavily silver plated on 1200 ampere switches. Lower ampere switches can be furnished with silver to silver or copper to copper contacts.

ABC INDUSTRIES

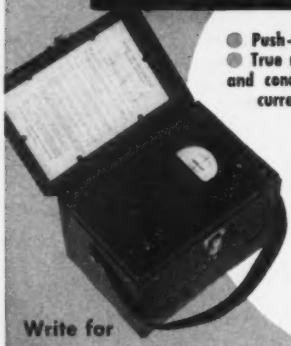
You know it's RIGHT when you specify CHANCE

A. B. CHANCE CO.

CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA

Simple • Accurate
GROUND RESISTANCE TESTING
with
VIBROGROUND

● Push-Button Operation ● Direct-Reading
● True readings, regardless of earth resistance and condition, stray frequencies, voltages or currents. ● Completely Self-Contained



YOU can be sure of safe, effective grounding of all types of electrical systems when you test with the light, easy-to-use Vibroground. Simple operation and built-in accuracy virtually eliminate reading errors. No leveling, cranking or outside power source is necessary; and direct readings are independent of auxiliary probe resistance.

Full data on Vibrogrounds, including testing techniques and illustrations, is yours for the asking.

Write for
BULLETIN 105

ASSOCIATED RESEARCH, Incorporated
"Precision Instruments Since 1936"

3760 WEST BELMONT AVENUE • CHICAGO 18, ILL.

SLASH OPERATING COSTS...
with Tel-E-Lect
POLE LINE EQUIPMENT

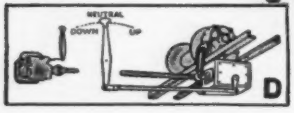
For installation on your present truck — or on new equipment

A POLE HOLE DIGGER . . . Uses your regular derrick and crew. Attaches by a single bolt to power take-off shaft. Adjustable for clean holes up to 10 feet deep. Interchangeable augers 8 to 20 inches diameter.

B DERRICKS . . . Both "A" frame and "T" type for front or rear mounting on all makes of trucks.

C UTILITY CABINETS AND MATERIAL RACKS . . . Bolts onto any flat bed truck. Gives needed facilities for pole line work at a fraction of the cost of a utility body.

D WINCH DRIVE BOX . . . Gives instant forward and reverse action to your winch. Permits operator to give all his attention to the winch job and speeds up work. *Easy to operate:* Simply engage power take-off just once. No further shifting to PTO or use of truck clutch required. Just move a single cab lever forward or backward to lower or raise the winch line. Available for single or double drum winches.



For literature or demonstration, write to
TEL-E-LECT PRODUCTS, INC.
10003 MINNETONKA BLVD. • MINNEAPOLIS 16, MINN.

without stripping, manufacturer reports. An adjustable thermostat makes possible close control over solder temperature and eliminates dependency on constant of line voltage.

A detachable splash guard protects operator against burns caused by splashing or overflow of solder; provides a receptacle to scrape dross into; gives a clean area around the pot.

There are two windings to the heating element—one operates continuously, the other is actuated by a thermostat, tending to level off the heat response curve. Operation is from a 110-v receptacle.

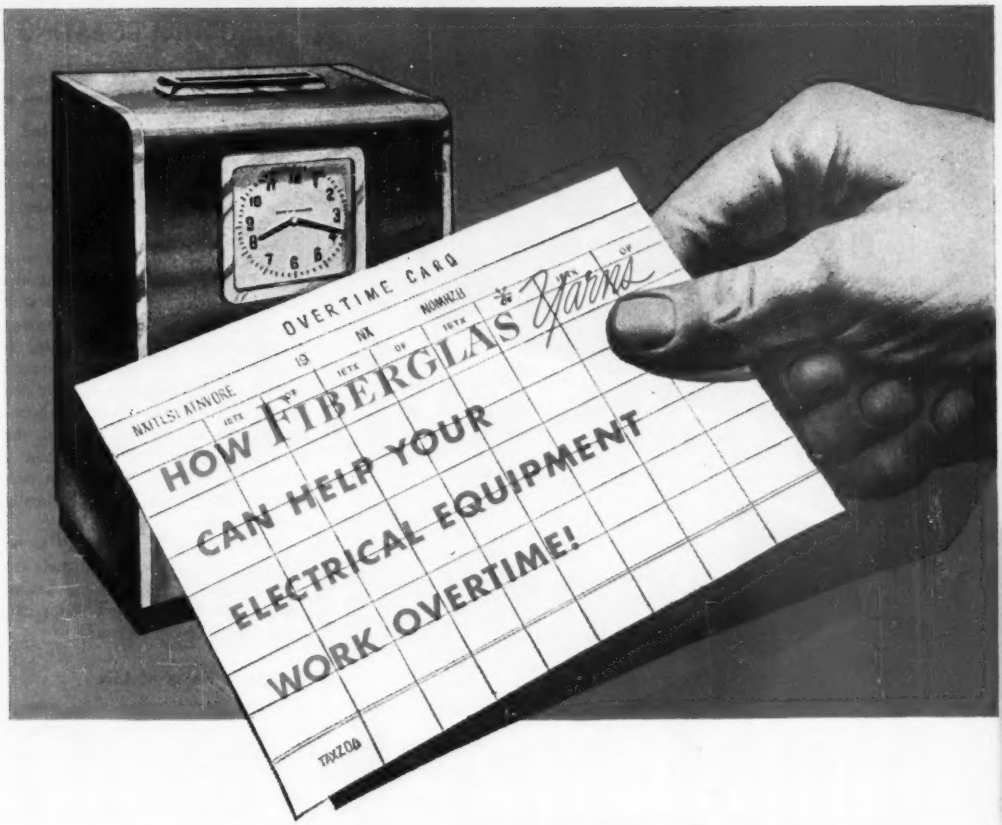
Dee Electric Co, 1101 N. Paulina St, Chicago 22, Ill.

MORE NEW PRODUCTS
about which you should know

The Cleveland Chain & Mfg Co, Cleveland 5, Ohio, offers a swing-out **transformer panel** for quick servicing of Bob-Cat electric cable hoists. By swinging transformer and contactors out of the way, motor brake is accessible. . . . Hewlett-Packard Co, 935 Page Mill Rd, Palo Alto, Cal., is manufacturing Model 337A-B FM **communications monitor** to provide emergency and communications networks. The unit is sensitive enough to monitor mobile units some distance away.

Monowatt, Inc, Providence 7, R. I., has a **triple-outlet tap** for use with No. 18, 2-conductor parallel cord which eliminates stripping insulation and securing wires to binding screws. . . . Gray Co, Inc, Industrial Div, Graco Sq, Minneapolis 13, Minn., is making a **materials handling pump** which will apply rust and corrosive preventives, calking compounds, and sound deadeners.

Scientific Instruments, Inc, Box 92, Homecrest Sta, Brooklyn 29, N. Y., has added Blacklite Model BL-U300 cold-cathode, **ultra-violet, fluorescent lamp** unit of 100 w; operates on 110-125 v, 60 cycles. . . . Arthur D. Little, Inc, had developed the ADL **electromagnet** for producing high flux density magnetic fields. Typical field strengths which may be ordered are 10,000 gauss and 35,000 gauss with ratings, respectively, of 20 and 125 kw.



In these days of serious national effort, your electrical equipment must work overtime to meet increasing civilian and military demands. Equipment will run longer, more efficiently, without breakdown if you:

- **Specify Fiberglas electrical insulations in the new equipment you buy.**
- **Specify Fiberglas insulations when you have old equipment repaired or rewound.**

Why Fiberglas? Because tough, long-lasting Fiberglas insulating materials resist heat and overloads, deliver superior service.

Space-saving characteristics of Fiberglas glass-base products also permit design of smaller, more compact, higher rated units which means conservation of other critical materials.

Because of increasing military requirements for Fiberglas Yarns, our customers are unable to get all they need. We are building new facilities to help meet these demands.

Send for your FREE copy of the booklet "Fiberglas Glass-Base Insulating Materials," Owens-Corning Fiberglas Corporation, Electrical Sales Division, Dept. 858, 16 E. 56th Street, New York 22, N. Y.

OWENS-CORNING FIBERGLAS *Yarns*

*Fiberglas is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibrous glass.

FIBERGLAS IS IN YOUR LIFE . . . FOR GOOD!

"Just the black ink, Johnny.
We're using only **KOPPERS POLES** *now!"*

● Koppers Poles *do* help to keep utility companies "out of the red." By *retaining* their strength, even under the severest climatic conditions, these poles drastically cut maintenance costs. And the exceptionally long pole life lowers annual operating expenses.

Not only do Koppers Poles make line operation more economical, but much *easier*, too. Just ask Line Supervisors!

Company Officials like the economies effected by Koppers Poles. Plus the customer good will created by the longer periods of *uninterrupted* service.

Purchasing Agents like to deal with Koppers. All transactions are businesslike. Deliveries are dependable. The high quality of the poles is uniform.

KOPPERS COMPANY, INC.
PITTSBURGH 19, PA.

KOPPERS PRESSURE-TREATED WOOD

WHAT THEY'RE SAYING
at industry meetings

Can Atomic Power Compete?

Sumner T. Pike, *U. S. Atomic Energy Commission, in a lecture series program at the University of Rochester, Rochester, N. Y.*

Nuclear breeding, may very well give us a reduction of cost of atomic power to where it can compete with our other sources. This process proven in the laboratory and to be tested in practice by a machine now nearly complete in Idaho means that we can very reasonably hope to get, by burning up a pound of nuclear fuel, the creation of somewhat more than a pound of new fuel. This is not perpetual motion but may practically amount to that.

Atomic power may turn out to be useful in areas where present fuels are very expensive, possibly long before most parts of the United States can economically put it to work.

Economic Facts of Life

H. N. Muller, *assistant to vice-president in charge of engineering, Westinghouse Electric Corp, at the Engineers' Convocation, University of Missouri, Columbia.*

The disturbing element today is the lack of realization by the individual that he must produce more to have more. The lesson must be re-learned that human wants can be satisfied only by productive effort.

The task of teaching is complicated by the attitude which important groups have toward corporation profits. It is high time to get the essential facts concerning the role of profits better known and better understood by large segments of the population. People must realize that part of the national production, whether it be called profits or anything else, must be plowed back to have the facilities to produce more. Let us remember that this is necessary under any system of government.

Of all the educated people, these simple economic facts should be evident to the engineer. Yet we know that a small proportion of engineers, along with a dangerously large sector of the general public, full or refuse to see why Americans live better than other people.

7500 hours of top-quality lighting make Westinghouse fluorescent lamps your best buy

Here's what the long life of Westinghouse fluorescent lamps means to you. In stores they last 2½ years . . . in one-shift factories and offices, over 3 years. Result? Fewer lamp replacements, lower maintenance costs. Worthwhile savings? You bet . . . and yours for the asking! So specify Westinghouse for all your fluorescent lamp needs. *There's no better value for your money!*

YOU CAN BE SURE...IF IT'S

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Lamp Division EW
Westinghouse Electric Corp.
Bloomfield, N. J.

Gentlemen:

Tell me more about how I can save with Westinghouse fluorescent lamps.

NAME.....TITLE.....

COMPANY.....

STREET.....

CITY.....ZONE.....STATE.....

HIRE ONE MAN

and get a crew

with a COFFING SAFETY-PULL HOIST

One man with a Safety-Pull Ratchet Lever Hoist does the lifting, pulling, holding work of many — in shop or field. Even the smallest Safety-Pull, weighing only 14 lb., delivers a 1500-lb. vertical or horizontal pull — is ready to go to work wherever hooked. Laying conduit, raising heavy transformers, stretching guys—these are but a few of the jobs it handles easily, safely.

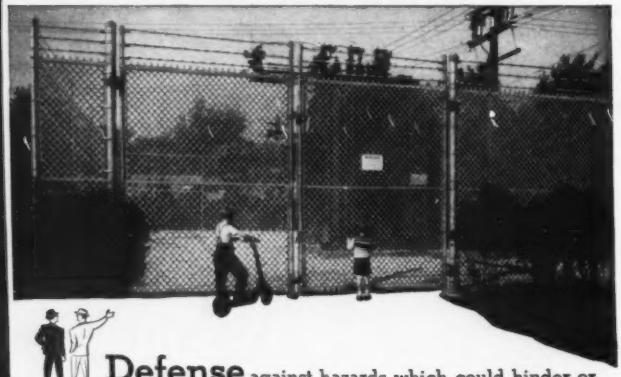
All Safety-Pulls are tested at 100 percent overload. Dual ratchet and pawl construction cannot slip—holds securely in any position. Choice of nine sizes with capacities up to 30,000 lb. Send for Bulletin E4SP.

Quik-Lift Electric Hoists • Hoist-Alls • Mighty-Midget Pullers • Spur-Geared Hoists • Differential Chain Hoists • Load Binders • I-Beam Trolleys

COFFING HOIST COMPANY
Danville, Illinois

PAGE FENCE - *Since 1883*

• AMERICA'S FIRST WIRE FENCE •



Defense against hazards which could hinder or stop production is a major function of Page Chain Link Fence, guardian of persons and property for more than 60 years. NOW is the time to consult the skilled Page Fence erecting firm near you, whose name we will send with fence data on request and who will submit cost estimates, no obligation. For information

Write to PAGE FENCE ASSOCIATION *in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Los Angeles, Philadelphia, New York or San Francisco.*

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

One Procurement Agency

George A. Sloan, *chairman, United States Council of the International Chamber of Commerce, before the Economic Club of Detroit.*

There should be one government agency in Washington, possibly the Economic Cooperation Administration, in sole charge of allocation and procurement of raw materials abroad, instead of the many overlapping agencies that have a governmental finger in the international economic pie. This agency also could consolidate all the scattered efforts of the United States in the foreign economic field. It should be headed by a man of outstanding ability with public acceptance.

United States foreign economic policy should be based, in part, on these pillars:

1. An increase of efforts to develop, procure, and allocate raw materials internationally.

2. Planning by business today beyond the emergency period.

3. Enlightened cooperation by governments to permit an extensive flow of capital abroad.

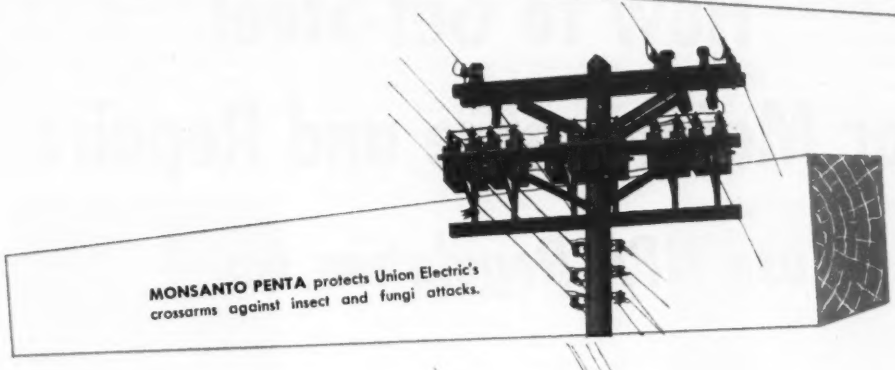
Continue Basic Science

Henry DeWolfe Smyth, *member, Atomic Energy Commission, at the Westinghouse Tenth Annual Science Talent Search Banquet, Washington, D. C.*

We must continue to support basic scientific research if we are to continue technological progress. If we have no further discoveries in basic science today, we shall have no developments in technology tomorrow. In the last 15 or 20 years, the gap in time between developments in fundamental research and the final development of practical machines has almost disappeared. The result is that today we have no backlog of basic science on which to draw. It is important that this be understood and that universities, foundations, and government give full support to fundamental research.

In the next 20 years a scientist must expect to work under limitations of secrecy in almost every branch of science. Our constant effort must be to limit secrecy to those areas where it is necessary for national safety and to remove it as quickly as we can from all other areas. This is today one of our most important responsibilities.

CLEAN TREATMENT FOR CROSSARMS



MONSANTO PENTA protects Union Electric's crossarms against insect and fungi attacks.

CROSSARMS treated with Monsanto Penta last years longer than untreated wood.

Union Electric Company of Missouri has standardized on penta (pentachlorophenol, technical) as the wood preservative for crossarms on both individual poles and towers for high-tension lines. Penta is a *clean* treatment that gives *positive* protection and keeps crossarms durable.

Penta, a chemical with stability, can be depended upon to give uniform treatment . . . *uniform protection*. Preserved with penta, wood is protected against decay caused by fungi . . . guarded against termites and other wood-boring insects. Properly formulated penta gives wood resistance to water while leaving the surface clean. Penta does not leach out of wood.

For information on the use of Monsanto Penta, contact the nearest Monsanto Sales Office or write for technical literature. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second St., St. Louis 4, Mo.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

MONSANTO
CHEMICALS AND PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

How to Get Steel for Maintenance and Repairs

use NPA Regulation No. 4

Business enterprises, government agencies and public or private institutions may now use a DO rating to obtain limited quantities of steel for maintenance, repairs and minor capital additions. The rating to apply is DO-97 as authorized by the NPA's new Regulation No. 4.

Obviously the use of this rating does not automatically get the steel because it is impossible to maintain complete stocks under present conditions. However, it does assure your order of preference over unrated orders and equal treatment with all other orders bearing a priority rating. If we have the steel you get it. Moreover, we can in turn extend the rating which should help us to maintain stocks for your future needs.

Because of broken stocks, we suggest you give us alternate sizes, gauges and qualities that would be acceptable. In this way you increase the chances of getting steel you will be able to use.

And remember, if your order falls within the provisions of Regulation No. 4 take advantage of it—use your rating! You can be sure that we will make every effort to take care of you as promptly and fully as possible.

If you do not have this Regulation No. 4 we will be glad to send you a copy.

PARTIAL LIST OF PRODUCTS—BARS • STRUCTURALS • PLATES
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STEEL-SERVICE PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • DETROIT • CINCINNATI • CLEVELAND
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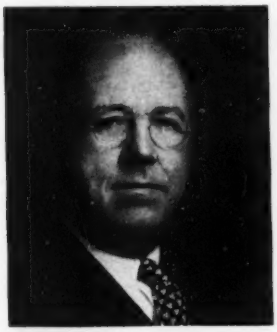
NEWS ABOUT PEOPLE

Thomas Haines Named VP of Boston Edison Co

Thomas H. Haines has been appointed vice president and associate director of engineering, steam, and electric operations of Boston Edison Co.

He joined the company in 1913 as assistant superintendent of maintenance and lines and in 1925 was named superintendent of the succeeding transmission and distribution department. In 1941 he was appointed assistant vice president. He later became coordinator of management personnel, setting up procedure to keep management better informed on company policy and industry activities. In 1948 he was appointed staff assistant to J. T. Ward, vice president in charge of engineering and operations.



T. H. HAINES

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H. E. Sladen, distribution engineer for the Fraser Valley district of British Columbia Electric Co, Vancouver, B. C., for the past four years, has been appointed distribution engineer in charge of the Greater Vancouver and Fraser Valley districts. He will be succeeded by **A. J. Duncan,** who has been district distribution designer at Abbotsford for four years. Duncan's post will be taken over by **Walter Marks,** distribution designer at Abbotsford. **F. J. Otte** has been named a distribution designer at Abbotsford. New distribution designer for the Fraser Canyon district is **John O. Dueckman.**

F. L. Carl, street lighting specialist of Westinghouse Electric Corp, has retired after 36 years' service with the company. Carl had served since 1920 as street lighting engineer for the nine states in the Westinghouse Northwestern district.

•

Grossman and Johns Promoted by Rumsey

George S. Grossman, vice president of Rumsey Electric Co, Philadelphia, has been elected vice president and general manager of the company. William T. Johns, Jr, Richmond, Va., regional manager, has been elected a vice president.

Grossman joined the company in 1922 as a salesman and was elected vice president in 1946. Johns, who will continue to operate from Richmond, joined Rumsey in 1929. Prior to that he worked in the engineering department of Virginia Electric & Power Co.

•

Richard B. Steinmetz, manager of the Marion mill of Anaconda Wire & Cable Co, has been appointed general manager of mills. New manager of magnet wire sales for the company, with headquarters at Muskegon, Mich., is **Maurice J. McCarthy, Jr,** formerly district manager of the Cincinnati territory. **Alfred Koch,** of the Muskegon office, will assist McCarthy. Steinmetz joined the Anaconda organization in 1929 with American Brass Co and the next year was transferred to Anaconda Wire & Cable. He served as district sales engineer in Boston and then Cleveland and other Mid-Western districts until World War II, when he became special Washington representative dealing with the Army and Navy. McCarthy has been in the Cleveland sales office for 20 years, the last 15 as district manager. He is a former vice president of the Cincinnati Electric Association.

GE Advances McCune; Shifts Made at Hanford

Francis K. McCune, assistant general manager of General Electric Co's Nucleonics Department at Richland, Wash., has been appointed manager of engineering of the company's Large Apparatus Division in Schenectady, N. Y. He succeeds Ernest E. Johnson, recently named general manager of the company's General Engineering Laboratory.

F. K. McCUNE

William E. Johnson, head of the construction program at the Hanford Works in Richland, succeeds McCune. Other Nucleonics Department appointments include those of Ralph E. Davison as manager and John S. McMahon as assistant manager of the newly formed engineering and construction divisions. The divisions formerly were known as the project engineering and design and construction divisions.

McCune has been with GE since 1928. He spent some time in the commercial department of International GE and in GE's West Lynn (Mass.) Works, where in 1945 he was named assistant works engineer. He returned to Schenectady in 1946, first as a member of the Apparatus Department design engineering staff and then assistant to the general manager of the department. In 1949 he became assistant general manager of the Nucleonic Department.

Davison recently has managed the

contract division of the design and construction divisions after starting at Hanford Works early in 1949 as assistant superintendent of the engineering office in the construction division. McMahon has been at Hanford since 1943, first as assistant housing superintendent in Richland.

•

New Assignments

Kenneth Anderson has been appointed superintendent of the Carlyle, Ill., municipal utilities. He has been with the Wilson Co, meat packers, in Cedar Rapids, Iowa. . . **Herbert B. Nechemias** has been appointed manager of the industrial sales department of Wagner Electric Corp. He succeeds **J. S. Smith,** who was appointed director of purchasing . . . **Lawrence G. Dougan** has been made supervisor of personnel in the Lynchburg district of Appalachian Electric Power Co. He succeeds **J. A. Mundy,** now employee relations supervisor in Roanoke. . . **John W. Kluberg** has been named controller of Consumers Power Co to succeed the late H. B. Hardwick. Kluberg has been with Arthur Anderson & Co, independent accountants and auditors who have handled the utility's annual audits. . . **Homer M. Gibbs** has been named to succeed Fred M. Shaw as rural development specialist with Texas Power & Light Co. . . **George H. Heller** has been appointed personnel and safety director for the western division of New York State Electric & Gas Corp, with headquarters in Lockport, N. Y. He succeeds the late Don S. Nosler.

•

L. B. McConaghy has been appointed rate engineer for New England Gas & Electric Association, Cambridge, Mass. He succeeds **E. S. Blech,** retired. Formerly McConaghy was engaged in rate work, contract negotiation, and sales promotion with Duquesne Light Co and Ohio Edison Co. He joined NEGEA Service Corp at Cambridge in 1948 after U. S. Army Signal Corps duty.

•

Stanley M. Gould has been elected president of the New England Meter Engineers Association. He is superintendent of the meter department, northern division, Western Massachusetts Electric Co, Greenfield.

Illinois Electric Porcelain Advances Roark, Foster

M. E. Roark has been appointed sales manager of Illinois Electric Porcelain Co, Macomb, Ill. James H. Foster, Jr, succeeds him as production manager.

M. E. ROARK

Roark joined the company in 1935 and was made production manager in 1937. He attended Notre Dame University and Western State College.

Foster attended Western State College and Park College, Parkville, Mo.

J. H. FOSTER, JR

During the last war he was field director for the American Red Cross in the Pacific. He has been with Illinois Electric Porcelain for four years.

•

Clinton H. Currier is the new assistant manager of the electrical products sales divisions of American Steel & Wire Co. He succeeds **Charles H. Eisenhardt,** who has been made manager of the electrical products sales division. Currier started with American Steel & Wire in 1926 as a checker and shipper in the Worcester Cable Works.

A. H. Middleton, former Grand River Dam Authority executive, has been named utility superintendent by the city of Pryor, Okla.

OBITUARY

Rudolf W. Staud

Rudolf W. Staud, 59, former president of the Illuminating Engineering Society and sales promotion manager of Benjamin Electric Manufacturing Co, Des Plaines, Ill., died March 28 at Evanston, Ill.

R. W. STAUD

Staud had been identified with activities relating to the development of higher uniform standards for lighting equipment for many years. He served as president of the RLM Standards Institute and director of the Chicago Lighting Institute.

In 1947 he was elected president of IES and previously had served as vice president. He also was a director and chairman of numerous IES committees. A member of the National Electrical Manufacturers Association, he served on many of its committees.

Staud joined Benjamin Electric in 1927 and was editor of "The Lighting Review and Digest."

•

Frank Wallace, 53, manager of power sales for Manila Electric Co, died in Manila March 27. He had been with the company since 1929.

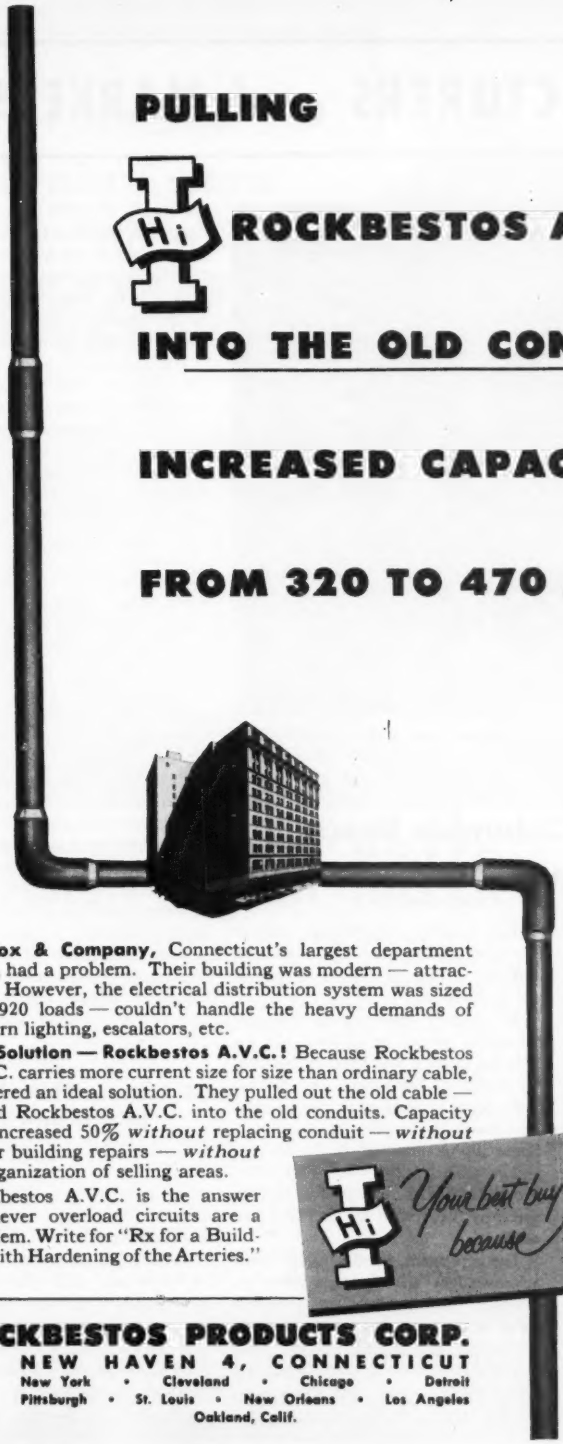
PULLING

ROCKBESTOS A.V.C.

INTO THE OLD CONDUIT

INCREASED CAPACITY

FROM 320 TO 470 AMPS.



G. Fox & Company, Connecticut's largest department store, had a problem. Their building was modern — attractive. However, the electrical distribution system was sized for 1920 loads — couldn't handle the heavy demands of modern lighting, escalators, etc.

The Solution — Rockbestos A.V.C.! Because Rockbestos A.V.C. carries more current size for size than ordinary cable, it offered an ideal solution. They pulled out the old cable — pulled Rockbestos A.V.C. into the old conduits. Capacity was increased 50% *without* replacing conduit — *without* major building repairs — *without* disorganization of selling areas.

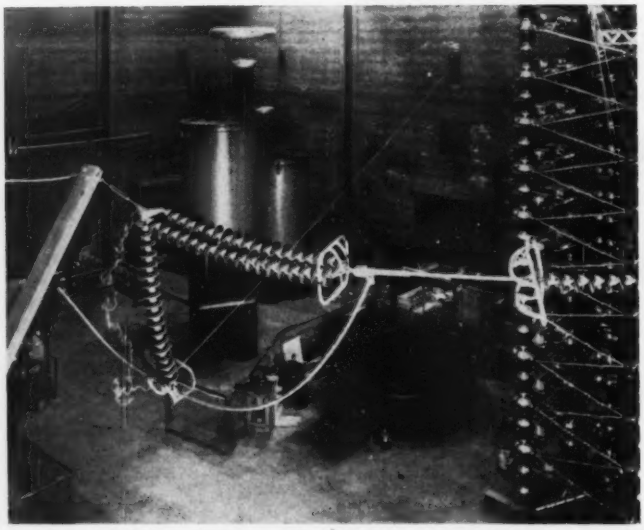
Rockbestos A.V.C. is the answer whenever overload circuits are a problem. Write for "Rx for a Building with Hardening of the Arteries."

- **You Use Existing Conduits** yet increase capacity 30 to 50%.
- **You Avoid Building Repairs** such as the bracing, replastering, repainting, normally required for major electrical alterations.
- **You Save Time** because A.V.C. can be pulled into place *fast*.
- **You Avoid Business Interruptions** since rewiring with A.V.C. in existing conduits is clean and easy.

Hi *Your best buy because*

ROCKBESTOS PRODUCTS CORP.
NEW HAVEN 4, CONNECTICUT
New York • Cleveland • Chicago • Detroit
Pittsburgh • St. Louis • New Orleans • Los Angeles
Oakland, Calif.

MANUFACTURERS and MARKETS



GRADING SHIELDS that are to be used on 315-kv line being built by American Gas & Electric Co in West Virginia are tested at Baltimore plant of Locke, Inc

Alcan and British Columbia Reach Agreement on Hydro Rental Fees

Aluminum Co of Canada has agreed to pay the British Columbia government an annual "rental" based on the price of aluminum for hydroelectric energy utilized in its proposed $500-million development in the Tweedsmuir Park area of central British Columbia. Hydro potential of the project is estimated at 1.5 million hp.

For each hp-year of electricity used in the production of aluminum or sold as secondary power Alcan will pay the government an annual rental equal to one and two thirds the average price per pound realized by Alcan on its B. C.-produced aluminum sold during the previous year.

With the price of aluminum at 18¢ per lb, this would work out at 30¢ per hp per year.

The agreement also gives Alcan the right to sell electrical energy to others, but under the jurisdiction of the B. C. Public Utilities Commission, and at the same rental as required of electric utilities. A floor of 25¢ per hp-year is set in this case.

In addition, the company will pay an annual rental of at least 10¢ an acre for lands it will flood by backing up waters of the Eutsuk and Tahtsa Lake water systems, with any overage also based on the price of aluminum. Some 300 sq miles will be flooded.

The rentals are in lieu of all other provincial levies, except for certain specified taxes such as land and income.

The agreement, in effect until 1999, acknowledges an initial payment of $20,000, and provides that money spent by Alcan in the last three years on engineering studies, designs, and specifications will be considered in lieu of further rentals until power production starts. Should Alcan get out of the B. C. field, it agrees to surrender its reports, plans, and engineering studies to the government.

A four-stage development program is laid down, with a conditional water license and flooding permit being issued by the government.

The agreement gives the company until June 1, 1953 to begin construction of the main works, and until Jan. 1, 1963 to get 400,000 hp in production.

By 1983 the company is to have 750,000 hp and on Dec. 1, 1999, the company will get its final license for the amount of power it is then producing.

If economic conditions will not allow meeting these dates, the lands minister may grant extensions.

The agreement also contains a provision for cutting down Alcan commitments if that company or a subsidiary builds elsewhere in Canada before the B. C. project reaches the 750,000 hp stage.

Plans and specifications must be approved by the water comptroller before construction can start.

The agreement provides for storing of 35 million acre-ft and a maximum diversion of 9500 cu ft per sec. Sources of water supply are the Nechako River above Grand Canyon, tributary streams and lakes, Skins Lake and Nanika River, and tributaries, except tributaries joining the Nanika more than two miles below Kidprice Lake.

•

GE Reopens Plant Hit by 4-Month UE Strike

General Electric's Oakland, Calif., transformer plant, closed late in February after being strikebound four months (EW, March 12, p 162), was reopened April 2.

Striking UE members voted March 28 to reverse their previous refusal of a proposed incentive program, accepting without reservation terms of a final GE offer made Jan. 31.

Members of the United Electrical, Radio & Machine Workers of America struck when the company proposed a

Chemical Brush Control with a

WALLOP!

ESTERON BRUSH KILLER

Yes, Esteron Brush Killer packs a wallop! This hard-hitting Dow formulation (4 pounds acid equivalent per gallon) now contains more powerful type esters of 2,4-D and 2,4,5-T—effective on a wider variety of brush and weeds and *much less* volatile than materials previously available. Easy and economical to use, Esteron Brush Killer gives good control of alder, ash, birch, brambles, cherry, elm, hickory, maple, oaks, osage orange, poison ivy, sumac, willow and other hard-to-kill species. It is effective also in controlling resprouting of stumps when it is applied in oil immediately following cutting.

A wealth of information on clearance and maintenance of right-of-ways and vegetation control around substations, pole yards, booster stations and along fence rows is yours on request. Dow sales and technical men are available for consultation and assistance. Write for Booklet IN-168 on "Vegetation Control."

Agricultural Chemical Division

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

Also recommended for woody plant control is Esteron 245. For controlling grasses such as Johnson, quack and Bermuda—use Dow Sodium TCA 90%. No fire hazard—and treated foliage will not poison grazing cattle. Ask your dealer or write direct.

DOW

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MUNCIE INDIANA

piecework incentive plan similar to those in effect at other GE facilities. A recent $2-million modernization had failed to bring hoped for reductions in manufacturing costs, and the company felt the incentive plan was the only way to put the plant on a money-making basis. Company spokesmen said that the new plan would allow workers to increase their earnings 15 to 20%.

The agreement guarantees the old job rate for three months, but provides for a 3% decrease after that time if the employee fails to increase his production. Workers are guaranteed at least 94% of the old job rate under any circumstances.

A letter to employees stated the plant was being reopened only under a "contractual agreement" that union leaders and employees cooperate fully in achieving successful operation. The letter said it might be some time before full production was resumed at the plant, since it had lost its place on the schedules of its suppliers and might have difficulty in obtaining materials.

SALES ASSIGNMENTS

COMPANY STAFFS

Trumbull Electric Manufacturing Co, Plainville, Conn., has appointed W. A. Edwards manager of the east central district, with headquarters at the company's Norwood, Ohio, Works. He has been switch, breaker, and control sales manager in Plainville.

Worthington Pump & Machinery Corp, Harrison, N. J., has named A. William Fraser, formerly general European manager, Midwest sales manager. He will direct sales of the Chicago, St. Paul, Kansas City, and St. Louis offices, with headquarters in Chicago.

Allis-Chalmers Manufacturing Co, Milwaukee, has appointed Frank R. Hunter manager of a new branch office of the general machinery division in Wichita, Kan. Hunter has been a sales representative in the Kansas City district office, of which the new office is a branch, since 1942.

National Electric Products Corp, Pittsburgh, has chosen T. M. Linton district manager of the Washington, D. C., territory. He has been with the company since 1937.

Metal Prices

April 2, 1951

COPPER, Conn. V., lb	$ .24½
LEAD, N. Y., lb	.17
ZINC, prime Western, E. St. Louis, lb	.17½
TIN, Straits, qual., N. Y., lb	1.50½
ALUMINUM, ingot, base price	.19
NICKEL, base price	.50½
STEEL, billets, Pitts., ton	56.00
STEEL, scrap, No. 1 heavy, Pitts., ton	45.00

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We Must Pay As We Go

***We** must do our utmost to pay as we go for our present defense program.*

On that proposition those who speak with authority are remarkably well agreed. This editorial – the second in a series on our mobilization for freedom – sets forth in simple terms why there is this agreement.

Next year – the fiscal year beginning next July 1 – the federal government's budget calls for the expenditure of $10 billion more than is scheduled to be collected in taxes. The deficit is due to the increase in defense expenditures.

A part of this deficit can be eliminated by cutting non-essential expenditures and increasing efficiency in the defense program. There is wide agreement on this. It is the duty of the President and Congress to see that it is saved.

How the remaining deficit anticipated in the federal budget—$5 billion to $10 billion—is handled is crucial. The government can meet it by raising taxes—by paying as we go. Or it can borrow, issuing more government bonds.

Borrow Again?

We relied heavily on borrowing in both World War I and World War II. In World War I only about one-third of the expenditures of the federal government were met by taxation. In World War II about 45 percent were met in this way. The rest we borrowed. Some people ask, why can't we rely heavily on borrowing again? Why is it crucially important to avoid adding $5 billion to $10 billion to a federal debt that is already $257 billion?

Part of the answer is found in the contrast between this defense program and our all-out effort of World War II. Another part—and one that is all-important in combatting inflation—results from the rapid decline in the purchasing power of the American dollar in recent years.

We went "all out" in World War II. We put almost half of everything we produced into our military effort. Taxes high enough to pay the financial costs as incurred would have meant huge tax increases. It was feared that such increases would kill financial incentives to get "all out" production. Since we expected the war to be short, borrowing seemed a safe expedient. Price control and rationing, with wartime patriotism to give them effective support, were relied upon to keep in check the inflationary pressure created by borrowing rather than taxing.

Our present defense program is scheduled to take a much smaller share of our production, but to take it over a much longer period. At its peak, the program as now planned will take only about 20 percent of our total national production. But, to use General Bradley's phrase, "the conditions under which we labor may persist for ten, fifteen and twenty years."

What About Controls?

For a period of any such duration it would be foolhardy to expect that the sort of controls we had for the few years of World War II could hold in check the inflationary pressure created by not paying as we go. It would be as foolhardy as it would be for a family to plan on borrowing to pay the expenses of a member discovered to be afflicted by a chronic ailment which might last a long lifetime.

Obviously, the only safe thing to do in such a case would be to adjust the family budget so that the expenses of the illness would be paid currently.

Our heavy reliance on borrowing in World War II had consequences which block a successful repeat performance.

If the borrowing had been done by persuading individuals to transfer their savings into government bonds, relatively little inflationary pressure would have been created. What the government would have spent with the proceeds of such bond sales would have been subtracted from the money individual consumers could spend.

But most of the borrowing was done from banks. That course expanded the amount of money available to the government without any offsetting subtraction of money from the hands of individuals. Thus, when direct price controls were removed after the war, this bottled-up purchasing power contributed to a price inflation which has cut purchasing power of the American dollar about in half – and decidedly changed the attitudes of the American people toward that dollar.

During World War II, Americans in general believed that:

The war would not last long.

The dollar would hold its value, and even gain value after the war.

Many wonderful new products would be available in the postwar period.

Today the American people have:

Seen the value of their dollars melt away fast.

Been assured that, at best, we may have a 10-15-20-year pull ahead.

Been warned not to expect a postwar paradise anytime soon.

One result of these changed attitudes is a notable lack of enthusiasm for government bonds on the part of individual investors. This is indicated by the fact that since Korea redemptions of E bonds have exceeded sales by about $600 million. Another result is a continuing rush to convert dollars into physical goods and equipment or claims on them. This trend weighs against financing the prospective federal deficit by borrowing from individuals.

Borrowing from banks to meet the deficit would again add fuel to inflation.

The prospective deficit is due to federal expenditures for military goods. Even if they are not blown up or shipped abroad, these goods will not be available to civilians. But the money paid to those who produce military goods will still be available to bid up the prices of civilian goods. Thus, at a time when people show relatively little disposition to save dollars, a menacing inflationary pressure – an inflationary gap, the economists call it – will be created.

If our fight against inflation is to be successful this gap must be closed by taxes. We need to do other things, too, for inflation has many different causes. Credit expansion must be effectively controlled. Production of civilian goods must be increased as much as possible by eliminating waste and inefficiency. But a pay-as-we-go tax program is basic to a successful attack on inflation. And inflation – unless it is checked – could wreck our defense effort.

We cannot pay as we go merely by soaking harder the corporations and those in the upper income brackets.

As the President's Council of Economic Advisers has reported, "by far the largest part of the additional revenue must come from the middle and lower tax brackets. These are the brackets in which the great bulk of the income is located."

Taxes Can Attack Inflation

By spreading tax increases broadly, taking small amounts from many people, inflationary pressure would be effectively reduced. It is the expenditures of the great mass of people, rather than the small numbers in the upper income tax brackets, that create most of the pressure. Moreover, it is possible to increase taxes broadly without killing the economic incentives to produce. Maintaining these incentives is essential to the success of the defense effort.

Our elected representatives cannot be expected to be enthusiastic about a pay-as-we-go tax program. It involves increasing the taxes of the great body of their constituents, an operation completely lacking in political glamour. However, such a program also involves the integrity of the American dollar. And that is absolutely essential to the success of the defense program. We shall be very foolish if we do not let our leaders know that we want them to do everything possible to pay as we go.

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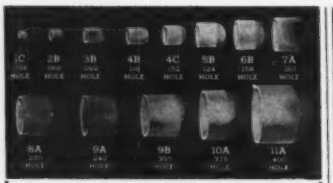

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NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Ala., Tuscumbia — Tennessee Valley Auth., New Sprankle Bldg., Knoxville, Tenn., electric power plant. **$47,000,000.**

Arizona—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., one 1,000-kva. unit substation for Phoenix sub-station, Davis Dam Proj., Spec. DS-3355. L. N. McClellan, ch. engr.

Arizona-Nevada—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Phoenix, Ariz., switchboard equip. etc. for Phoenix dispatchers' office, Davis Dam Proj., Spec. DS-3362. L. N. McClellan, ch. engr.

Colo., Greeley—Home Light & Power Plant, Greeley, expansion facilities at power plant, **$440,000.**

Conn., Plainfield—Trumbull Elec. Mfg. Co., 41 Woodford Ave., factory, **$750,000.** Lockwood Greene Engineers, Inc., 10 Rockefeller Plaza, New York, N. Y., consult. engr.

Ill., Aurora—Electric Storage Battery Co., 19 St. and Allegheny Ave., Phila., Pa., battery plant, **$1,000,000.**

Ind., Centerton—Indianapolis Power & Light Co., 17 N. Meridian St., Indianapolis, installing 68,000 kw turbo-generator at White River power plant.

Ia., Waverly—City, diesel power plant equipment auxiliary equip. bldg. alterations. Stanley Eng. Co., Hershey Bldg., Muscatine, engrs.

Kan., Riverton—Empire District Electric Co., Joplin, power station addns. **$7,000,000.**

Missouri—Consolidated Electric Co-operative, Inc., Mexico, 19.65 mi. rural distr. lines, 53.36 mi. line conversions, 82.14 mi. line renewals in Audrain, Montgomery, Pike and Monroe Counties. Proj. 36H MPR Audrain. Plans deposit $10. Birenbaum & Smith, 7510 Delmar Blvd., University City, engrs.

Missouri—Kansas City Power & Light Co., 14 and Baltimore Sts., Kansas City, Mo., 6 power line to connect with planned line of Union Electric Co. from Bagnell Dam power plant, Miller Co., Mo., Jackson, Clay, Ray, Carroll and Chariton Counties.

Nev., Hawthorne—Pub. Wks. Office, Twelfth Naval Dist., Federal Office Bldg., Civic Center San Francisco, Calif., secondary electrical distr. sys. imprvs. and replacements at Naval Ammunition Depot, Contr. NOY-22903, Spec. No. 25386. Plans deposit $10.

New Mexico—Farmers Electric Co-operative, Clovis, 244 mi. distr. lines, sys. imprvs. and completing previously approved constr., Curry Co. **$360,000.** REA allct. Tynes & Loftin, Korber Bldg., Albuquerque, consult. engr. Charles Gilbert, c/o owner, engr.

N. M., Las Cruces—U. S. Eng., P. O. Box 1538, Albuquerque, 32x94 ft., masonry electrical generator bldg.; sub-station with five 167 kva transformers and 125 lin. ft. chain link fence, White Sands Proving Ground, Electric Power Addn., Phase II, (P-50-3), Serial No. Eng 29-005-51-29. Plans deposit $10.

Ohio—Columbus & Southern Ohio Electric Co., 215 N. Front St., Columbus, imprv., expansion transmission sys., **$14,500,000;** extend and imprv. distr. sys., **$11,500,000;** misc. imprvs., **$2,500,000.**

O., Athens—Columbus & Southern Ohio Electric Co., 215 N. Front St., Columbus, install two 68,000 kw generating units at E. M. Poston power station, near here. **$26,500,000.**

Oregon—Bonneville Power Admin., 827 N. E. Oregon St., Portland, Ore., construct double circuit sect. Maupin-Detroit 230 kv. line Marion Co., Inv. 5666. Plans deposit $25.

Pa., Scotland—General State Auth., 18 and Herr Sts., Harrisburg, electrical distr. sys. at Pennsylvania Soldiers' Orphan

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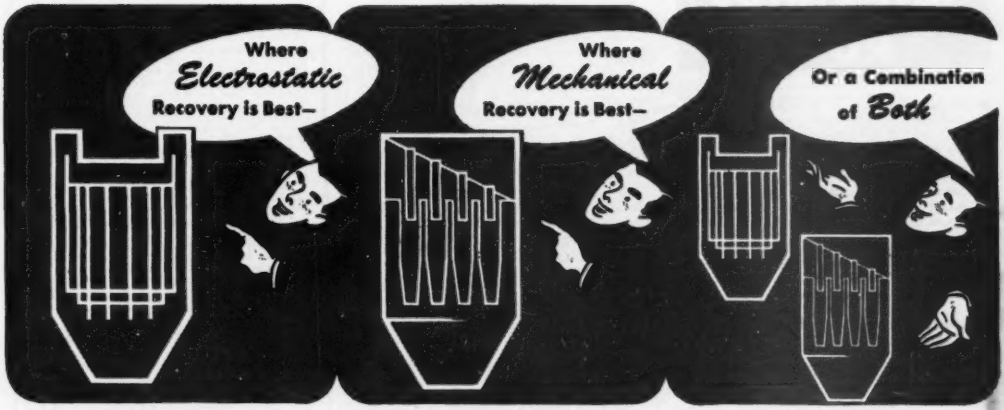

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South Dakota—U. S. Eng., 1709 Jackson St., Omaha 2, Neb., powerhouse for Fort Randall Reservoir Project, Charles Mix Co. near Lake Andes, Spec. No. CIVENG 25-066-51-102. Plans deposit $50.

Texas—State Hy. Comn., Austin, expreseway illumination system, Hy. US 75, from point south of Bryan St. to point north of McComas Ave. in Dallas. Control No. 47-7-29, FP No. U 515 (15).

Tex., Dallas—Dallas Power & Light Co., 1915 Wood St., shop, $225,000; equipment and vehicle parking facility bldg., $102,000; garage, repairing, $200,000.

Low Bidders & Contracts Awarded

Colo., Boulder—Austin Co., 16112 Euclid Ave., Cleveland, O. Contract Awarded. $45,000,000. Rocky Flats Atomic Energy radiological Research plant, near U. S. Atomic Energy Comn., 109 E. Place Ave., Santa Fe, N. M. To be operated by Dow Chemical Co., Midland, Mich.

Ind., Terre Haute—Gust K. Newberg Co., 2040 N. Ashland St., Chicago, 13, Ill. Contract Awarded. Total est. $30,000,000, substructure only for power plant. Public Service Co. of Indiana, Traction Bldg., Indianapolis, Ind.

Me., Millinocket—Stone & Webster Engineering Co., 90 Broad St., New York 4, N. Y. Contract Awarded. $6,000,000 Design and construct hydro-electric proj. at Ripogenus Dam on Penobscot River. Great Northern Paper Co., 6 State St., Bangor, Me.

Oklahoma—C. L. Carter Co., Vinita, Okla. Contract Awarded. $266,000, est. $275,000, sub-station addn. and 66 kv lines, Ispa 389, at Gore, Muskogee Co., Southwestern Power Admin., P. O. Drawer, 1619, Tulsa 1, Okla. Awarded Mar. 3.

Pa., Philadelphia—Phila. Electric Co., 900 Sansom St., Phila., Pa., Separate Contracts. $500,000. Palmer St. Sub-station, United Engineers & Constructors, Inc., 1401 Arch St., Phila., Pa., engr.

Tex., Houston—Houston Lighting & Power Co., 1016 Walker St., Houston, Tex., Purchase and Hire. $5,575,000, generating units (where needed) totalling 60,000 watt; $685,000, enlarging imprvs. sub-station.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ariz., Phoenix—Hughes Tool Co., Gulf Bldg., Houston, Tex., guided missiles plant, on 160 acre site. $50,000,000.

Calif., Sacramento—State, P. Wks. Bldg., Sacramento, Calif., plans by Harry A. Thompsen, Jr., and Alec L. Wilson, 315 Montgomery St., San Francisco, Calif. State Employment Department Bldg. $7,000,000.

La., Lake Charles—Continental Oil Co., Oil & Gas Bldg., Houston, Tex., modern refinery plant. $10,000,000.

Mass., Brocton—Veterans' Admin. Technical Service Munitions Bldg., Wash., D. C., hospital bldgs., utilities, Manly and West Chester Sts., No. 7-4050, $17,000,000.

Mich., Midland—Midland Hospital, Leo Bliss, chn., brick, steel, concrete hospital, $1,200,000.

Tenn., Millington—Bureau Yards & Docks Annex, Navy Dpt., Arlington, Va., plans by Wyatt C. Hedrick, 1st Natl. Bank Bldg., Fort Worth, Tex., military installation, $50,000,000.

Tex., Longview—Tennessee Eastern Corp., Longview, ethyl alcohol, synthetic units. $5,787,000.

Tex., Port Arthur—Gulf Oil Corp., Port Arthur, Tex., refinery plant. $18,485,342.

Low Bidders & Contracts Awarded

Ill., Chicago—Ragnar Benson, Inc., 4744 W. Rice St., Chicago, 51, Ill. Contract Awarded. Total Approx. $17,000,000. Main bldg.***Darin & Armstrong, 2041 Fenkel Ave., Detroit, Mich., machinery foundation ***W. E. O'Neil Constr. Co., 2751 Clybourn St., Chicago, 14, Ill., forge plant*** Sherman-Olson Co., 600 W. Jackson St., Chicago, 6, Ill., foundry bldg.—rehabilitation of aircraft engine bldg. Ford Motor Co., 7401 S. Cicero St., Chicago 29, Ill.

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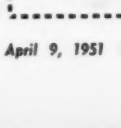

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● ELECTRICAL FITTINGS: The complete line of solderless wire connectors, cable and conduit fittings and wiring devices is described in Catalog 1050. There are many illustrations showing use of Pres-Sure connectors for solderless wire splicing. Buchanan Electrical Products Corp, 1290 Central Ave, Hillside, N. J.

● FIXTURES: Descriptive sheet D-5010 contains photos and specifications for the company's line of 425-ma, T-12 slimline lamp fixtures. Colonial Electric Products, Inc, East Paterson, N. J.

● INDUCTION MOTORS: Construction features of two-pole squirrel cage induction motors in ratings 900 hp and larger are covered in Bulletin 05B7550. They are built for boiler feed pumps and other high-speed drives. Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis.

● SAFETY BELTS: A complete line of safety belts for linemen and structural steel workers is covered in 4-page Bulletin CF-26. Mine Safety Appliances Co, Braddock, Thomas and Meade Sts, Pittsburgh 8, Pa.

● EDUCATIONAL EQUIPMENT; TABLE: GEA-5526 deals with educational equipment for electrical laboratories including rotating apparatus, loading devices, instruments, motor control equipment, distribution equipment, and dynamometers. Also included are transformers, reactors, and an Amplidyne control and servo-mechanism kit. GEA-5172A is a 2½x4-in. listing of energy consumption for various rural and home appliances. General Electric Co, Apparatus News Bureau, Schenectady 5, N. Y.

● CRANES: A 24-page brochure, No. 400-R-2, contains many pictures showing application of American Revolver cranes in the construction of 12 large dams. American Hoist and Derrick Co, St. Paul 1, Minn.

● EXTENSION CORDS, PLUG CAPS: Catalog 161 covers R-30 and R-40 lamps, attachment plug caps, extension cord sets, and fluorescent accessories in a 24-page three-color catalog. Allied Electric Products, Inc, 68-98 Colt St, Irvington 11, N. J.

● PHASE SEQUENCE INDICATOR: Data sheet 7A contains information and uses for the company's pocket-size phase sequence indicator for 115, 220, or 440-v circuits. Associated Research, Inc, 3760 W. Belmont Ave, Chicago 18, Ill.

● ROTATING MACHINES: Ac and dc rotating machines for school laboratories are covered in four new bulletins. GEC-743, motor-generator sets for dc study; GEC-744, m-g sets for studying synchronous machines; GEC-745, m-g sets for ac motor study; GEC-747, dc exploring coil sets for oscillograph studies in dc armatures. General Electric Co, Apparatus Dept, Schenectady 5, N. Y.

● FEEDWATER HEATER: Two-page Bulletin S-201-A describes a feedwater heater for preheating feedwater in small power plants of 300 hp or less. The Swartwout Co, 18511 Euclid Ave, Cleveland 12, Ohio.

● TELEMETERING, PYROMETER: Bulletin DM029, a folder containing information on use of Metameter telemetering instruments, shows typical installations at generating stations, tie lines, etc. Thermocouple and pyrometer accessories are listed in 56-page Bulletin P1238, along with installation sketches. The Bristol Co, Sales Promotion Dept, Waterbury 20, Conn.

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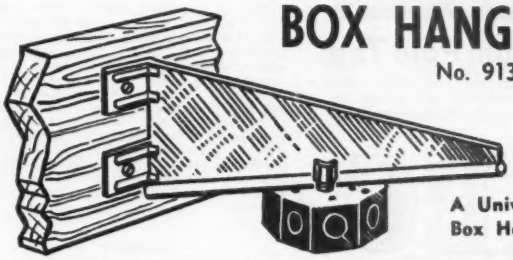

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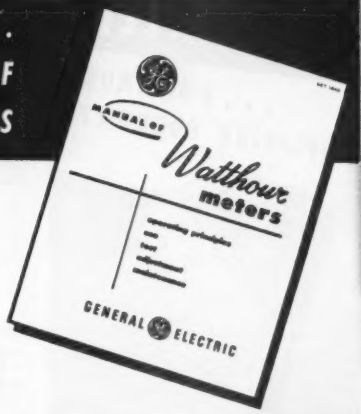

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BOOK REVIEWS

Transformers

Transformer Engineering. **By L. F. Blume et al. Published by John Wiley & Sons, Inc., New York 16, N. Y. 500 pages, illustrated. Price $7.50.**

This is a second edition (first 1938) and it records the 13 years of advances that have been made in insulations, TCUL practice and the greatly increased knowledge of thermal characteristics which has enlarged the resort to "loading by temperature". These new samples should indicate that the book tells more about using transformers to best advantage (connections, fault limitation, grounding, cooling) than it does about the details of design for fabrication. It remains, therefore, the outstandingly authoritative reference on transformer application and operation.

Nucleonics

Applied Nuclear Physics. **By E. Pollard and W. L. Davidson. Published by John Wiley & Sons, Inc., New York 16, N. Y. 352 pages, illustrated. Price $5.**

When the former edition appeared (1942), the first chain reaction pile had not been built in Chicago. The book therefore reorients the treatment of all the background and practicalities of nuclear physics because such stupendous things have happened in the 9 years. Physicists are prone to consider the discussions of application of their research findings as beneath their dignity, but not these two. The discussion of the power pile in Chapter 11 will be of particular interest to power system engineers as an evolution of the Oak Ridge and Hanford piles. This, along with cosmic rays, concludes the evolution of the whole art from Rutherford's 1904 discovery of the alpha particle and 1912 delineation of the nuclear atom.

Deck Bridges

Welded-Deck Highway Bridges. **Edited by James G. Clark. Published by James F. Lincoln, Arc Welding Foundation, Cleveland 1, Ohio. 247 pages, illustrated. Price, $2 in U. S., $2.50 elsewhere.**

This book was compiled from entries in the Foundation's 1949 award program, "Welded Bridges of the Future". The program emphasized development of new designs, new methods of fabricating and erecting, new steel sections, all towards the objective of better bridges at less cost and made with less steel. The book is divided into 5 sections—structural types, floor systems, new sections, special connections and details, quantities and costs.

Semi-Conductors

Semi-Conductors. **By D. A. Wright. Published by John Wiley & Sons, Inc., New York 16. 130 pages, illustrated. Price $1.75.**

An elementary approach founded on the mobility of the electronics in metals, crystals and semi-conductors. In addition to emission phenomena, a section of interest in connection with rectifiers and transistors is that devoted to contacts between metals and semi-conductors.

Transmission

Travelling Waves on Transmission Systems. **By L. V. Bewley. Published by John Wiley & Sons, Inc, New York 16. 543 pages, illustrated. Price $12.**

The 1933 edition has been greatly enlarged to incorporate the advances in the art of analysis since then. More than ever, therefore, the book affords a basic and practical approach to design of lightning-proof transmission and the behavior and fortification of transformers in the face of high-frequency oscillations and internal transients.

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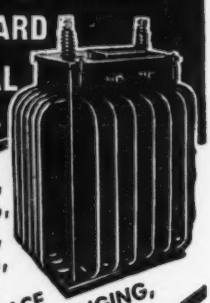

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U. S. Government

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Specification No. DS-3351) will be received by Bureau of Reclamation, Denver, Colorado, until April 26, 1951, and then publicly opened for furnishing three 115-kv, 1,200-amp, 3,500,000-kva, 3-pole power circuit breakers; and eighteen 115-kv, 600-amp, 3-pole disconnecting switches for Flatiron and Pole Hill switchyards, Colorado-Big Thompson Project, Colorado. Delivery is desired within 180 days. For particulars, address Bureau of Reclamation, Building 1-A, Denver Federal Center, Denver, Colorado.

A. C. POWER

3–150 K.W. DIESEL GENERATOR SETS

Buckeye–600 r.p.m.–medium speed Westinghouse generator–440/3/60–complete with modern dead front switch gear. Units equal to new–used only 50 hours.

IMMEDIATE DELIVERY

Write—Wire—Phone

THE

BOSTON METALS CO.

313 E. Baltimore Street
Baltimore, Md.

LE 1900 CU 5050

DIESEL POWER

FOR

IMMEDIATE SHIPMENT

UNIT CAPACITIES—10 TO 1875 KVA

A.C.—50 AND 60 CYCLES

VARIOUS VOLTAGES

A PARTIAL LISTING OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1875	Fairbanks Morse	33F16	2000	300	375	Enterprise	D6C–6	450	450
1430	Fairbanks Morse	38D8¼	1600	720	330	Superior	KNA	396	514
1300	General Motors	16–278A	1600	720	312	General Motors	8–268A	480	1200
937.5	General Motors	12–567	1080	720	312	Clark	MD–4	375	827
625	Alco	6–15¾x12T	750	600	187	Ingersoll Rand	8	225	514
438	Baldwin	VO–6	510	450	125	General Motors	3–268A	180	1200
400	Buckeye	50	480	600	75	General Motors	3043C	90	1200

D.C. UNITS ALSO AVAILABLE

A. G. SCHOONMAKER COMPANY, INC.

ENGINE DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

FROM AVAILABLE STOCK

TURBO GENERATORS

Qu	KW	Make	Desc.
2	750	G.E.	Condensing — 425 lbs. 750 TT. I.S.P. 440V. 3 ph. 60 cy —(Built 1944
1	625	Westg	Non-cond. 125 lbs. I.S.P. 5/20 lbs. B. P. 440 v. 3 ph. 60 cyc.
1	400	Westg.	Non-condensing—125/150 lbs. I.S.P. 5/10 lbs. B.P.—240/480 v. 3 ph. 60 cy.
1	300	G.E.	Non-condensing 150/175 I.S.P. 5/10 B.P.—480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

	KVA	Make	Type	Volts	Speed
1	5140	Whse.		2400/4150	600
1	4000	G.E.	TSC	2400/4150	900
1	3000	Whse.		2400/4800	720

MOTOR GENERATOR SETS

3 ph. 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
2	2000	G.E.	600	600 25 cy	11000
1	1800	G.E.	900	125/250	2300/4150
1	1500	G.E.	300	275	2300/4400
1	1000	Whse.	900	600	4150
1	1000	G.E.	900	600	2300/4150
1	750	G.E.	900	275	4150
1	750	Whse.	900	275	2300/4150
1	500	Whse.	900	250	440
1	500	G.E.	720	125	2300
1	400	G.E.	720	250	440/3200
1	350	G.E.	900	125	4150

TRANFORMERS—60 Cycle

	KVA	Make	Type	Ph	Voltages
2	4000	G.E.	HT	3	22000x2300
3	3666	Whse.	OISC	1	66000x11000
8	1250	G.E.	HVDDJ	1	6600x460
9	833	Phila	OISC	1	26400x26000
6	250	G.E.	HT	3	13200x240/480
12	150	G.E.	HT	3	2400/4150x240/480

BELYEA COMPANY, INC.

OFFICE & SHOP

51 Howell St., Jersey City 6, N. J.

– FOR SALE –

COMPLETE POWER PLANT

. . . now partially operated

2 – 1,000 kw Turbine Generators

1 – 750 kw Turbine Generator

1 – 35 kw Turbine Generator

All with Complete Control Equipment

CAN BE INSPECTED AT—

MID-CONTINENT PETROLEUM CORP. REFINERY—*Tulsa, Okla.*

Contact W. G. WARNOCK, *Manager*
Materials & Purchasing Department
Box 381—Tulsa, Oklahoma

FOR SALE

CABLE

1-Reel 1548 ft., 250 MCM, 259/.034", 6/64" VC and Braid Crescent
1-Reel 600 ft. (approximate) Ditto
1-Reel 300 ft., 400 MCM, 37 x 104, 6/64" VC and Braid Okanite
1-Reel 200 ft., 400 MCM, 61 x 7/.0306 AVC Table L, Spec. CL400 Rockbestos
2000 ft. #10, 3/C, 600 V., 105/.010 Rubber, G-E
(Approx. in random lengths 50 to 200 ft. each)

All new material and, except last item, on original reels.

THE WOLFE & MANN MFG. CO.

28th & Sisson Streets Baltimore 11, Maryland

TRANSFORMERS

3—1667 KVA 33, K.V. to 8.9 with taps above and below.
3—1000 KVA same specifications.
These transformers practically new. Purchased 1943 used short time.

PHILA. TRANSFORMER CO.
2829 Cedar St. GArfield 6-1800 Phila. 34, Pa.

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4160V, 2300V Pyranol
1—1000 KVA G.E., 3 Ph., 4160V 2 Ph., 2400V
3— 400 KVA G.E., 1 Ph., 6600V, 2300V Sec
1— 250 KVA Maloney, 1 Ph., 13,800V, 240/480 Sec
1— 150 KVA G.E., 3 Ph., 4160V 120/208Y
1— 50 KVA G.E., 1 Ph., 13,486V, 120/240V Sec.
1— 25 KVA G.E., 1 Ph., 440/220, 220/110 Sec.

WELDERS

3— 500 Amp. Westinghouse Flex Arc Welders 220/440 sing. phase

MOTOR GENERATOR SETS

1—1000 KW G.E., 600V, 514 RPM, 4600V Syn.
1— 150 KW G.E., 125/250V, 1200 RPM, 2300 Syn.
1— 100 KW El. Mchy. 125V, 1200 RPM 4150V Syn.
1— 75 KW G.E., 250V, 1200 RPM, 2300 Syn.
1— 40 KW El. Mchy., 125V, 1200 RPM, 440V S.C.

SLIP RING MOTORS

1—2500 HP G.E., WT, 257 RPM, 6600V
1— 250 HP Westc., CW, 600 RPM, 440V

SYNCHRONOUS CONDENSER

1—2500 KVA Whse., 720 RPM, 2200V with D.C. Exc.

Large Stock of A.C. and D.C. Equipment

LETTERS TO THE EDITOR

Farewell From A Friend

To the Editor:

My subscription to the "Electrical World" has expired. I do not want it renewed, at least not badly enough to pay the price.

Over two years ago our competitor tormented us into selling out of the electric utility business. This was reported in your magazine. Kentucky Edison Co serving four counties in this area was sold to two REA's. Being small we were one of the earlier private companies to be swallowed by the socialists. The larger ones will come later. Therefore my 27 years in the electric power business came to an end. I don't like it. We are now in the natural gas business and creosoting business and I don't like that either. Nothing wrong with it except that I miss the generators, meters and the 60-cycle hum of the transformers. These gas meters compare to electric meters in the order of a farm wagon to a good car.

Thank you for the years of good reporting and news of the electrical industry. I shall miss the "Electrical World," but I hardly feel justified in continuing its subscription. It makes me a bit homesick and renewing my bitterness does not help.

In doing this, I feel a little guilty, like abandoning an old friend.

May you continue to bring the electrical news to the greatest American industry.

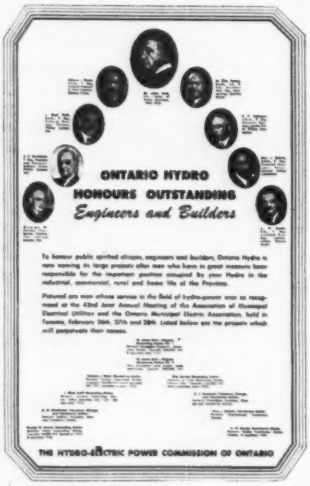
Harry Peet, Jr.
Kentucky Creosoting Co.
Stanton, Ky.

How Canada Does It

To The Editor

I am enclosing herewith an advertisement which appeared recently in Ontario newspapers. It is a coincidence that this advertisement should be published as you write your editorial on page 62 of the February 26th issue entitled "Glamorize the Engineer."

What you advocate is being carried out here. The Chairman of the Hydro-Electric Power Commission of Ontario, Mr. Robert Saunders, himself a



lawyer, at the dedication of new power plants has always referred in glowing terms to the engineers responsible for the design and construction. . . It is now the established policy of the Ontario Hydro-Electric Power Commission to name all new plants after engineers connected with the projects. . .

The Association of Professional Engineers of Ontario for the past two years has been carrying out an aggressive public relations campaign through radio talks. . . This is also combined with articles in the daily and weekly papers giving publicity to engineers connected with new projects. I am convinced that Ontario has made remarkable progress in publicizing the engineer.

E. V. Buchanan
General Manager
London Public Utilities Commission
London, Ontario

Engineering Unity

To the Editor:

I have read your most excellent editorial in the Feb. 26 issue of "Electrical World" on "Unity of the Engineering Organization." I think you have done an excellent job in outlining the four plans proposed by the special committee and perhaps you are right in recommending that both plans A and D be adopted.

My own opinion is that the matter goes a whole lot deeper than has been set forth in your outline. The present technical societies have served most excellently as media for the transfer of technical information in their various fields. They have neglected and will continue to neglect the sociological and economic problems facing the engineer because they are not constituted for that end.

Members of the engineering profession really break themselves down into two groups: (1) The strictly theoretical engineers; and (2) the practical or management engineers. I do not believe that you will ever sell . . . engineering profession unity to the strictly theoretical engineers and scientists. Therefore, any plan that depends for its success on organization of the present societies is doomed to failure. I am personally in favor of plan D because it is a separate society that holds to the American tradition of freedom of choice.

The engineering profession and the engineering societies have been playing with professional unity for some years and it is . . . most important that something be done and done quickly. The particular plan which is adopted is of not anywhere near as great import as a plan that will receive the wholehearted support of a substantial majority of the engineering profession. . . .

F. S. Bacon, Jr.
700 Shepard Avenue
Hamden 14, Conn.

Industrial Lighting

To the Editor:

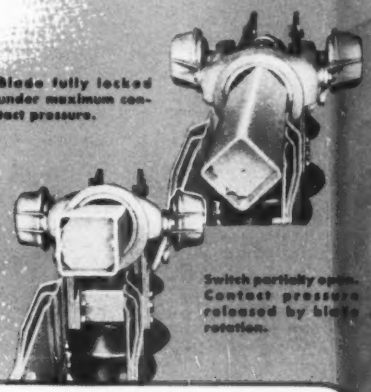
An extra copy of your article "Good Lighting and Color Stimulate High Industrial Production," in the Feb. 26, 1951, issue of "Electrical World" will be appreciated if such is available. We found the article to be very interesting by its author Mr. Egeler and feel that it will be of help to us in our engineering work.

Charles A. Lawler
H. E. Bovay, Jr., Consulting Engineers
Houston, Texas

NOW A NEW IMPROVED "MK-40" IN RATINGS TO 4000 AMPERES

Profit by lower installation and maintenance costs plus improved electrical and thermal characteristics when you install these modern high capacity, group operated switches. Available in ratings up to 4000 amperes; 7.5 to 69-kv inclusive; for horizontal upright, vertical or underhung mounting positions. For full information ask for Publication 4904—

High capacity "MK-40" for 23-kv, 4000-amperes.



Blade fully locked under maximum contact pressure.

Switch partially open. Contact pressure released by blade rotation.

Here's why the "MK-40" is winning the acclaim of engineers

NOW —a new arrangement of contact shoes permits uniform contact pressure and increased thermal conductivity. Rolled silver inlays at points of contact reduce contact resistance and abrasion to a minimum. Hard drawn copper current carrying parts are arranged in a straight line current path from terminal-to-terminal.

NOW —a powerful blade actuating mechanism, employing only three moving parts, opens and closes the blade smoothly without stops, shunts, cranks or auxiliary devices. Blade is locked automatically in fully opened or closed positions.

NOW —greaseless, non-rusting ball bearings on all essential rotating parts. Threadless pipe fittings thruout operating mechanism facilitates rapid switch alignment. Adjustment remains permanent.

WHEN YOU WANT THE BEST IN HIGH VOLTAGE SWITCHES SPECIFY "MK-40"

DELTA-STAR ELECTRIC COMPANY

CHICAGO 12, ILL.

DIVISION OF H. K. PORTER COMPANY, INC.

DISTRICT OFFICES IN PRINCIPAL CITIES

Above: Shown are four of the five big turbines of the Colorado Springs Municipal Utilities. NONPAREIL Turbine Oil helped operators "wash their hands" of oil-system maintenance troubles.

Left: J. J. Tyler (left), Standard Oil lubrication specialist, and W. J. Whelan, plant engineer, discuss the written guarantee given with each fill of NONPAREIL Turbine Oil.

Washed their hands of turbine-lubrication trouble!

NONPAREIL
TRADE MARK
Turbine Oil

Operators of the Colorado Springs Municipal Utilities had their hands full keeping oil systems clean in three big turbines. At least once a year, sludge and varnish had to be removed from the lubricating systems. Moreover, gradual deterioration of the lubricant used in the turbines made it necessary to replace fills of oil approximately every three years.

The recommendation of a Standard Oil lubrication specialist changed all of that. Operators took his advice and switched their turbines to NONPAREIL Turbine Oil.

Throughout ten years of operation, oil systems have stayed clean. The original fills of NONPAREIL have shown no appreciable deterioration, and neutralization numbers have remained below 0.10 KOH/gm. As a result, no fill of oil has needed to be replaced. The men of the Colorado Springs Municipal Utilities report: trouble-free lubrication by NONPAREIL has pared lubrication and maintenance costs to the bone! Since the switch to NONPAREIL, two new turbines have been added. Both of these units are lubricated with NONPAREIL Turbine Oil.

Trouble-free, low-cost lubrication is assured the Colorado Springs Municipal Utilities not only for 10 or 15 or 20 years but for the life of their turbines. This assurance is based on a written guarantee, given with each fill of oil to all NONPAREIL users, that NONPAREIL Turbine Oil will maintain a neutralization number below 0.15 KOH/gm. for the life of the turbine it lubricates. NONPAREIL has borne out its guarantee by having served, in individual turbines, for as long as 22 years without once being removed or replaced.

Ask a Standard Oil lubrication specialist to show you actual case histories from utility plants where NONPAREIL has reduced lubrication costs as much as 65%. You can reach a lubrication specialist by phoning your local Standard Oil Company (Indiana) office. Or, write:

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

STANDARD OIL COMPANY (INDIANA